The AUTOMOBILE

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Tire Prices Advanced

Goodyear and Goodrich Start Ball Rolling with Increases Reaching to 15%

NEW YORK, Dec. 31—Goodyear and Goodrich have taken the initiative in regard to raising their tire prices for 1917, the increases reaching 15 per cent. The advance follows the prediction made recently that tire prices would advance just as soon as one of the companies announced an increase. Now that two of the largest companies have taken the first step, it is expected that the others will follow suit. At the present time Fisk and other tire manufacturers are working on price readjustments and will announce their changes in a day or two.

Other Companies Change Prices

The United States Tire Co. has advanced prices 15 per cent in casings and 10 per cent in tubes, with some adjustments with respect to certain grades and brands. Ajax has followed suit with an advance of between 10 and 15 per cent. Lee Rubber & Tire Corp. has advanced prices 15 per cent on all its regular tires. The Kelly-Springfield Tire Co. will order an advance of about 20 per cent within the next 2 or 3 days.

Swinehart tire prices have been increased 15 per cent on pneumatics, 10 per cent on solid tires, and 15 per cent on tubes. Firestone has advanced prices 15 per cent on casings, and 10 per cent on tubes. Miller wrapped tread tires have been increased 10 to 15 per cent and the tubes 5 to 10 per cent. Portage advances are 15 per cent on tires and 10 per cent on tubes.

Goodyear has advanced its prices 15 per cent on pneumatic tire casings and 10 per cent on pneumatic tubes and truck tires. Goodrich prices have advanced from a fraction to 10 per cent.

It is expected that prices will advance in general from 15 to 20 per cent. The following list gives the new lists of Goodyear and Goodrich:

Goodrich

Size	Old	New
28 by 3	$9.35	$11.10
34 by 4	21.34	23.45
36 by 4	22.55	24.90

Goodyear

28 by 3	$9.55	$11.50
34 by 4	22.40	25.75
36 by 4½	31.55	36.30

The increase was to be expected, considering the increase of crude materials and of cost of labor. A comparison of a few of the materials' price increases shows that the advance is warranted:

	Nov. 1, 1915	July 1, 1916	Nov. 1, 1916	P. C. Increase
Sea Island cotton	.67	.76½	1.20	79
American cotton	.39	.46½	.61½	57
Egyptian cotton	.66	.66	1.00	51
Rubber Ceylon grades	.61½	.58	.63	3

S. A. E. Appoints Members of Army Truck Specification Board

NEW YORK, Jan. 3—At the request of Colonel Baker President Russel Huff of the S. A. E. has appointed A. L. Riker, member of the Naval Consulting Board and chief engineer of the Locomobile Co.; H. D. Church, chief engineer Packard truck department; and the chairman of the standards committee, to serve on the army board that is engaged in preparing truck specifications. The next meeting of the board takes place Jan. 5.

Barton Heads Northway Motor

DETROIT, Dec. 30.—Henry Barton has been made president of the Northway Motor & Mfg. Co. Mr. Barton has been an executive of the General Motors Co. for several years.

Allyn Is Ben Hur President

CLEVELAND, OHIO, Jan. 3—L. L. Allyn has been made president of the Ben Hur Motor Co., this city, of which he was formerly director and secretary.

1916 Production Total 1,617,708

1,525,578 Cars and 92,130 Trucks Built—Sales Over Billion Dollars

NEW YORK, Jan. 2—Retail sales of automobiles in the United States for 1916 have passed the $1,000,000,000 mark, according to figures given by Alfred Reeves, general manager of the National Automobile Chamber of Commerce. Sales last year exceeded 1,600,000 passenger and freight-carrying automobiles, the average price being $605 for passenger cars and $1,809 for trucks. These vehicles were made by more than 400 companies and sold by 30,000 dealers throughout the United States and foreign countries.

To be exact, there was a production of 1,525,578 passenger cars and 92,130 trucks, a grand total of 1,617,708 vehicles. The passenger cars were valued at $921,378,000, while the trucks show $166,650,273, or a total of $1,088,028,273, which is the retail price paid for vehicles by American and foreign buyers.

$1,880,073 Net for Stewart-Warner

CHICAGO, Dec. 29 — The Stewart-Warner Speedometer Corp., this city, reports for the 9 months ended Sept. 30 last net profits of $1,880,073 and net surplus after dividends and premiums paid of $1,320,826. Cash on hand and in bank amounted to $112,711 and total assets and liabilities to $15,061,019.

Lutz Co. to Make Steamers

BUFFALO, N. Y., Dec. 29—The Lutz Motor Co., this city, capitalized at $200,000, is looking for a site for a factory to build steam automobiles. The directorate is composed of G. H. Lutz, New York; O. H. Lutz, San Antonio, Tex.; L. R. Lupton, East Aurora, and G. B. Burd and J. H. McLean, Buffalo.

Distinctive Bodies at Salon

Fifteen Car Makes on Exhibition, Only Three of Which Are Foreign

NEW YORK, Jan. 2—Fifteen makes of cars, only three of which are foreign, all typifying the latest developments in the bodymaker's art, are on exhibition here at the thirteenth annual salon which opened at the Hotel Astor to-day.

Distinctive qualities of the designs are the use of smaller bodies with compact lines and hung low on the chassis, the extended use of a semi-dull finish, the disappearance of tufted upholstery in many cases, and the careful attention to detail.

A number of cars at the salon are revealed for the first time at a public exhibition. These are the Biddle, Daniels, Murray, Phianna and Novara.

Novara a Speed Type

The Novara is a small, special speed creation, built only to order, and is to be marketed by G. N. Thurber, of the Isotta-Fraschini Motors Co., and Sidney De Wolf Herreshoff. It will be built in the plant of the Herreshoff Mfg. Co., Bristol, R. I. But one style will be made, this being a distinctive roadster model, with a mahogany body built like the hull of a yacht. The car is equipped with a 3 by 4¼ block high-speed overhead-valve four cylinder motor, having drilled Lynite pistons and drilled connecting-rods; the speed capabilities are over 50 m.p.h. on second speed, and over 70 m.p.h. on high. The weight is 1500 lb., the wheelbase 110 in., the tires 31 by 4, and the price $2,750. A one-piece windshield, devoid of binding, and rolled fenders hugging the wheels tightly and minus the usual skirt to the body, give a distinctive touch.

Among the extreme body styles there is a Lancia hydroplane, a sporty type of roadster devoid of top or windshield and finished entirely in dark maroon. The cowl is the highest part of the body, the lines sloping back to a rear deck.

Both Locomobile and White have comprehensive exhibits, including nearly every type of body. In the Locomobiles, an innovation is equipment with dictagraphs. One body is a sporting cabriolet in which the closed portion of the body entirely disappears; the usual side lamps are set into the windshield, leaving the exterior of the body entirely unobstructed. Another is a special boat type in which the top body line breaks sharply at the cowl and is continued straight back to a commodious rear deck; seats are adjustable. A feature of the Locomobiles is the use of accelerator pedals the full length of the foot and shaped like the sole of a shoe. One Locomobile has the top body line beveled instead of fitted with the usual molding.

The pointed front closed car is a popular style, both White and Locomobile showing these. In them the body lines are perpendicular at the sides. White has two pointed front coupes, both finished semi-dull; these, with the other Whites, are equipped with the new sixteen-valve four-cylinder motor. Another White model is a boat type cloverleaf roadster, with a slanting, pointed windshield, and a beveled top body line. One noticeable feature of all these custom bodies is the trim manner in which fenders hug the wheels.

Daniels has an unusual type of white touring car fitted with a black Victoria top, and equipped with a windshield at the back of the front seats, which slides up or down.

The highest priced car at the salon is a town car with a long wheelbase and small body which sells for $15,000 or $2,000 higher than the most expensive car shown at the salon last year. There are several other cars exhibited which come near this figure, notable among them being a Rolls-Royce with an aluminum body, black disk wheels and black fenders, selling for $13,000.

Following is a complete list of car exhibitors:

Car	Exhibitor
Biddle	Biddle Motor Car Co., Philadelphia
Brewster	Brewster & Co., L. I. City
Daniels	A. E. Ranney Co., New York
Fiat	Fiat Motor Sales Co., New York
Isotta-Fraschini	I-S Motors Co., New York
Lancia	T. E. Adams, Inc., New York
Simplex-Crane	Simplex Automobile Co., New Brunswick, N. J.
Singer	Singer Motor Co., Long Island City, N. Y.
White	White Motor Co., Cleveland
Locomobile	Locomobile Co. of America, Bridgeport
Murray	Murray Motor Car Co., Pittsburgh
Novara	G. M. Thurber and Sidney De Wolf Herreshoff, New York
Phianna	John G. Dale, New York
Roamer	Roamer Motor Co. of New York, New York
Rolls-Royce	R. W. Shuette, New York

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New Seneca Car Sells at $735

FOSTORIA, OHIO, Dec. 28—A four-cylinder, five-passenger car selling for $735 will be manufactured by the Seneca Motor Car Co. It will have an L-head Le Roi motor giving 27 hp. at 2200 r.p.m., disk clutch and three-speed gearset in unit. Cooling is by thermo syphon, the carbureter is a Zenith and the electric equipment consists of a Remy distributer, Willard storage battery and Allis-Chalmers starting and lighting system, 30 by 3½ tires with demountable rims and non-skid tires in the rear are standard and the wheelbase is 118 in. A three-passenger roadster will also be manufactured.

Overland Prices Are Higher

Willys-Knight and Overland Delivery Cars Higher—Reo and Olds Up

TOLEDO, Dec. 25.—Effective to-day, the Willys-Overland Co. has inaugurated a new schedule of prices on Overland and Willys-Knight cars. The Overland Country Club model has risen in price to $750 from $695, the Willys-Knight coupe has advanced from $1,500 to $1,650, 1200-lb. Overland delivery wagon has gone up to $850 from $775, and several of the other models have seen like advances, as follows:

Model	New Price	Old Price
90-Touring	$665	....
90-Roadster	650	....
Country Club	750	$695
Panel delivery	700	625
Express delivery	675	595
85B-4 Touring	850	795
85B-4 Roadster	835	775
85B-4 Touring Coupe	1,250	1,045
85B-4 Touring Sedan	1,450	1,195
85-6 Touring	985	925
85-6 Roadster	970	....
85-6 Touring Coupe	1,385	1,175
85-6 Touring Sedan	1,585	1,325
88-6 Touring	1,325	....
84 Coupe	1,650	1,500
1200 lb. delivery	850	775

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Reo Increases Six Price $100

LANSING, MICH., Dec. 30.—The Reo Motor Car Co. has increased the prices of six-cylinder touring car and roadster models from $1,150 to $1,250. Other models are being continued at former prices, but the company states that it will be unable to guarantee these prices throughout 1917.

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Oldsmobile Prices Raised $100

LANSING, MICH., Dec. 30—Prices of the Oldsmobile cars have been raised $100, effective Jan. 1. This makes the eight-cylinder seven-passenger touring car $1,367, while the five-passenger touring car, four-passenger club roadster and two-passenger roadster are $1,295. The price of the seven-passenger car was incorrectly given as $1,295 in the description appearing in THE AUTOMOBILE for Dec. 28.

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Scofield Heads Drexel Sales

CHICAGO, Dec. 30—H. H. Scofield has become director of sales for the Drexel Motor Car Corp., this city. Among his previous connections were Acme White Lead & Color Works, Studebaker Corp., General Motors Co. and Paige-Detroit Motor Car Co. Mr. Scofield has selected the following factory representatives: L. M. Roberts, Eastern territory, formerly with Winton and King; W. E. Hobbie, Southern territory, formerly with Buick, and H. E. Dickinson, Middle West, formerly with Oakland.

314,583 Automobiles in N. Y.

313,583 Owners Registered Representing 279,930 Cars and 34,653 Trucks

NEW YORK, Jan. 2—Registrations in this State for 1916 totaled exactly 446,205, divided into 313,583 owners, representing 279,930 passenger cars and 34,653 trucks, while 2494 dealers and 25,812 motorcyclists received their certificates and 104,414 chauffeurs their licenses, all contributing $2,642,158, or $742,245 over 1915.

Trucks' Gain Doubles 1915

Although the entire gain in cars was over 36 per cent, the rate of gain in the registration of trucks and delivery wagons over 1915 was almost double the general increase, the percentage being 65 per cent. In 1914 there were registered 17,141 commercial vehicles; in 1915, 20,880, and in 1916, 34,653.

The number of manufacturers and dealers registered also showed a marked gain. From February, 1915, to Jan. 31, 1916, there were 2198 firms that held registrations for trucks. Last year the number reached 2494.

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Travis Is Locomobile Sales Manager—Other Promotions

BRIDGEPORT, CONN., Dec. 28—Several important transfers and promotions are announced by the Locomobile Co. of America as having been made in the last few weeks.

E. A. Travis has been appointed general sales manager. Mr. Travis was formerly assistant sales manager and previous to that time was manager of the Locomobile branch at Boston.

P. W. Hine, formerly associated with the sales department at the Executive Offices, has been appointed to the management of the Bridgeport branch and territory. He is also in charge of the service rendered by the Bridgeport factory to Locomobile owners.

D. G. Roos has been appointed assistant chief engineer. C. B. Amorous, formerly assistant purchasing agent, enters the general sales department.

T. E. Swayne has been transferred from the Oakland, Cal., branch to the management of the Los Angeles branch, a position formerly held by J. M. Page, appointed to the management of the Chicago territory.

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Approve Continental Motors Corp. Plan

DETROIT, Jan. 2—The stockholders of the Continental Motors Co. held a special meeting last Saturday and approved the recommendations of the committee of stockholders that a new corporation be formed to take over the business. The new company is being organized under the laws of Virginia. It will have a maximum capital stock of $18,500,000, of which $3,500,000 will be preferred and $15,000,000 will be common stock.

Practically all of the stockholders have deposited their stock with the Security Trust Co. and accepted the plan, and they will receive $5 cash and three shares of the common capital stock of the new company, which will be known as the Continental Motors Corp., in exchange for each share of common stock of the present company.

The new company will have the same board of directors, with two new members who are to be selected.

It is stated that the new company's common stock will be placed on a dividend basis at an early date and that the new concern will have ample cash working capital, which will increase the output and greatly augment the profits.

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New Selden 1-Tonner

ROCHESTER, N. Y., Dec. 29.—A new 1-ton Selden truck has been produced by the Selden Truck Sales Co. of Rochester which is practically identical with the older 1-ton model except that it has a Russel internal-gear-driven rear axle. The other 1-tonner has a worm drive. This is the second Selden to be equipped with internal-gear drive, the other being the 2-tonner. As is the case with the 2-tonners, the internal-gear-driven 1-tonner sells for less than the worm-driven one, $1,385 as against $1,700.

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Peerless Postpones Price Increase

CLEVELAND, Jan. 2 — The Peerless Motor Car Co. has decided to postpone making an increase in the price of its products until Feb. 28. The new Peerless price will be $1,980 for the roadster or touring car.

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Maxwell Truck Chassis $795

DETROIT, Jan. 3—The Maxwell Motor Co., this city, will sell its new 1-ton truck chassis for $795. There will be three bodies, an open express with integral cab and side curtains, $95 extra; a panel body with integral cab, $105 extra; and a box body with integral cab, $55 extra.

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Crow-Elkhart Plans 9000 Cars

DETROIT, Jan. 2—The Crow-Elkhart Motor Co. of Elkhart, Ind., is planning to produce more than 9000 cars this year. Arrangements have been made which will give the company more than 250,000 sq. ft. of floorspace. The factory plans provide for a yearly production rate of 6000 cars in January, 9000 cars in March and 30,000 cars by December.

To Talk on S. A. Opportunities

Barrett of Pan-American Union Will Speak at Annual S. A. E. Dinner

NEW YORK, Jan. 3—John Barrett, Director-General of the Pan-American Union, Washington, will be first speaker at the annual dinner of the Society of Automobile Engineers, Hotel Biltmore, Thursday evening, Jan. 11. His subject will be "Pan-Americanism; Its Great Trade Opportunities." There is no man better qualified than Mr. Barrett to go into the possibilities of increased sale of U. S. A. automobiles in South America and, in fact, in all of the twenty-one Latin-American countries which occupy the Western hemisphere from the northern boundary of Mexico to Cape Horn.

Mr. Barrett will have another message in connection with foreign trade after the war, owing to the fact that the past 2 months he has been on official foreign trade work in England and France, his chief motive being to find out what European countries are going to do in the way of re-establishing themselves in Latin-American trade when hostilities cease. Mr. Barrett while abroad conferred with the highest officials in both countries with reference to manufacturing, financing and foreign policies in general with regard to Latin America.

On Jan. 11 Mr. Barrett will have completed 10 years of service as Director-General of the Pan-American Union. He has served 23 years in foreign diplomatic fields and has been one of the staunchest advocates of the U. S. A. establishing itself more firmly in Latin-American markets.

Howard E. Coffin, of the Naval Consulting Board, and who has been devoting most of his time to preparedness work, will review what has been accomplished to date in this work.

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$2,000,000 Corporation to Make Cleveland Independent Center

CLEVELAND, Jan. 2—Plans are under way for the formation of a $2,000,000 corporation which will attempt to bring to Cleveland one or more makers of every part and appliance of the automobile. Under present conditions Cleveland motor car makers suffer from railroad embargoes, delayed freight shipments, damages in transit, etc.

The $2,000,000 corporation planned will purchase the business of out-of-town concerns or purchase an interest in them. At this time Cleveland car makers are purchasing more than $6,000,000 worth of bodies out of town and depend on Detroit for most of their engines.

New York May Boost Truck Fees

Special Commission Recommends Double to Fourteen Times Present Fees

ALBANY, N. Y., Dec. 29—Registration fees for motor trucks in this State will be increased to from twice to fourteen times the present $5 flat rate if the legislature approves the report filed with the Secretary of State here to-day by the special truck fee commission. If the proposed schedule is made into law, all commercial vehicles having a combined weight of truck and carrying capacity load of 2 tons or less will have to pay $10, or double the present fee. This classification would include all of the 1000-lb. delivery vehicles and the ¾-ton trucks.

In Effect Feb. 1

The proposed fees will go into effect on Feb. 1, provided the schedule as filed is authorized by this year's Legislature. Although the 1916 Legislature delegated the power to fix taxes to the truck fee commission which has just filed its proposed schedule, Governor Whitman has admitted that it is unconstitutional to so delegate such a power. As a result, the schedule must pass the Legislature before it can go into effect. The time between now and Feb. 1, 1917, offers ample opportunity to protest against the unfair schedule which appears herewith.

From the minimum fee of $10, the charges increase in $5 increments for increases in weight up to $70 for trucks of combined weight of chassis and load not to exceed 14 tons. Trucks whose total weight is in excess of 14 tons will have to pay $70 plus $10 for each additional ton of weight above that amount if the measure becomes a law. The 14-ton classification would include 7-ton trucks with a chassis weight of approximately 6 tons, a body of 1 ton and a load of 7 tons. This $70 tax is fourteen times the present fee.

Buses Would Suffer

Aside from the increased fees for motor trucks engaged in the ordinary pursuits of commerce, the schedule filed would also increase the fees for motor buses, basing the charges solely on seating capacity. A motor bus with a seating capacity of five or less would be charged $15 yearly up to $67.50 for those with seating capacities for between twenty-seven and thirty passengers. Such fees would place a great burden on the buses of the Fifth Avenue Coach Co., New York City, each of which already pays a yearly tax of $781 including State and city registration fees, franchise taxes for the use of the city streets and personal property corporation taxes.

Provision is made in each schedule so that vehicles registered after August 1 in any year will have to pay only one-half the yearly fees.

The truck fee commission consisted of Edwin Duffey, highway commissioner, Chairman; W. W. Wotherspoon, superintendent of public works, and Frank M. Williams, State engineer.

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$376,353 in Royalties for Kelly-Springfield Tire

CHICAGO, Dec. 30.—The United States District Court has confirmed the report of the master of chancery recommending that the B. F. Goodrich Co. and the Republic Rubber Co. pay the Consolidated Rubber Tire Co., now the Kelly-Springfield Tire Co., the sum of $376,353.50 in royalties. The cases brought against the first two concerns by the Consolidated Rubber Tire Co. involve the old Grant tire patent No. 554,675, issued Feb. 18, 1896, and the tire, channel and wire patents connected with it, and alleged violation of patent license. In the case against the B. F. Goodrich Co. the royalties amount to $262,298.95; the Republic Rubber Co., $114,064.65. Interest, which will be between $15,000 and $20,000, will bring the total amount to about $400,000. A similar case against the Diamond Tire Co. has yet to be decided.

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Electric Vehicle Assn. to Dissolve

NEW YORK, Dec. 31—The Electric Vehicle Assn. of America, this city, has made application to the Supreme Court for its voluntary dissolution because all the members, 1141 of them, on April 14, 1916, joined the electric vehicle section of the National Electric Assn. The association has no liabilities and assets of $2,832.

Rhode Island Has New Law

Fees Are Higher—Registration Now by Calendar Year—Age Limit 16

PROVIDENCE, R. I., Jan. 1—The new automobile law passed by the last legislature went into effect to-day. As a result automobilists now find that there are several things that will tend to operate toward better conditions on the Rhode Island highways. All the vehicles must now be lighted ½ hr. after sunset and continue so until ½ hr. before sunrise when on the roads. This makes the law similar to the one in the other New England States. There is a change now in the registration and instead of cars being registered for a year dating from when the fee was paid all the registrations begin Jan. 1 and end Dec. 31 as in many other States.

There is a change in the fees, too. Under the old law all the cars under 20 hp. were taxed $5; from 20 to 30 it was $10; so that now the limit for $5 cars is 15 hp. That means a lot of the small cars will be forced to pay $10 instead of $5. The next class is from 15 to 30 hp. which pays $10, so there is not a lot of difference. The other ratings of $15 for 30 to 40 hp. remain the same as does the $25 price for cars above 40 hp. The trucks have been graded according to tonnage. The old fee was $7 flat. The rates now go from $7 for under 1 ton to $40 for more than 9 tons.

It is estimated that there are more than 18,000 cars registered in Rhode Island of which more than 8000 are owned in Providence. There are about 2700 trucks in the State, 1000 of which belong in Providence.

No person under 16 may operate an automobile, whether or not accompanied

SCHEDULE OF FEES FOR MOTOR VEHICLES USED AS BUSES

Seating Capacity	Yearly Fee or Tax
Five or less	$15.00
Not less than six or more than seven	24.50
Not less than eight or more than ten	40.50
Not less than eleven or more than sixteen	43.00
Not less than seventeen or more than twenty	52.00
Not less than twenty-one or more than twenty-two	55.00
Not less than twenty-three or more than twenty-six	61.50
Not less than twenty-seven or more than thirty	67.50

For each vehicle having a seating capacity of more than thirty, the fee of $67.50 must be paid in addition to a fee of $2 for each passenger seat provided in excess of thirty.

SCHEDULE OF FEES FOR MOTOR TRUCKS

Combined Weight of Truck, Including Chassis, Body and Capacity Load	Yearly Fee or Tax
Two tons or less	$10.00
More than 2 tons and not more than 3	15.00
More than 3 tons and not more than 4	20.00
More than 4 tons and not more than 5	25.00
More than 5 tons and not more than 6	30.00
More than 6 tons and not more than 7	35.00
More than 7 tons and not more than 8	40.00
More than 8 tons and not more than 9	45.00
More than 9 tons and not more than 10	50.00
More than 10 tons and not more than 11	55.00
More than 11 tons and not more than 12	60.00
More than 12 tons and not more than 13	65.00
More than 13 tons and not more than 14	70.00

For each truck whose total weight is greater than 14 tons as outlined above must pay the fee of $70 plus an additional fee of $10 for each ton in excess of that weight.

by a licensed driver. Special licenses may be issued for a particular type of vehicle. No vehicle may be operated on the roads unless it is registered. All courts must submit reports of reckless driving to the Board of Public Roads, and that body will consider suspensions and revocations. All accidents must be reported to the board also. No driver may pass a trolley car on the side that is open to discharge or receive passengers. After an accident the operator shall stop and make himself known to the persons with whom he was in collision, or to any proper officer.

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Klaxon Maker Reported Sued Under Anti-Trust Act

NEWARK, N. J., Dec. 30—Suit was brought to-day against the Lovell-McConnell Mfg. Co., this city, maker of the Klaxon horns, by the Department of Justice in the Federal District Court to secure injunctions under the Clayton anti-trust act to prevent enforcement by the defendant of constant stipulations that jobbers handling its automobile horns shall handle no others and shall sell horns at prices the Lovell-McConnell Co. fixes.

President D. A. McConnell states that there could be nothing about the suit that could in any way pertain to the company's business dealings directly with the makers as such sales were made on an entirely different basis. As yet Mr. McConnell has not received any official notification that the suit has been brought. Mr. McConnell also adds that he does not know whether present proceedings are based upon the old form of contract or the present and if there were any valid objections to any part to the present form of contract the Klaxon company would be glad to make changes as desired if they were really found to be inequitable.

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Autolock Patents in Suit

CLEVELAND, Dec. 30—Suit has been filed against the Defender Autolock Co., Detroit, charging infringement of patents on key-operated electric and Autolock switches owned by Warren R. Cox, manager of the automobile department of the Blackburn Specialty Co., this city. The devices made under these patents are K-W Autolock for Ford cars, made by the K-W Ignition Co., the sole licensee under Mr. Cox's patents, and Blaco Autolocks for all other makes of cars.

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Scott Goes to Old Hickory

LOUISVILLE, KY., Dec. 30—E. G. Scott has joined the staff of the Kentucky Wagon Mfg. Co., this city, and will demonstrate the Old Hickory truck in Ohio. Mr. Scott was formerly with the Kissel Motor Car Co. and the Packard Motor Car Co.

No Government Car Tax

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No Emergency Revenue Legislation Likely To Affect Automobile Taxation

WASHINGTON, D. C., Dec. 30—There will be no emergency revenue legislation at this session of Congress other than a measure authorizing the sale of Panama Canal bonds to the value of $125,000,000, according to information from such a reliable source that its authenticity cannot well be doubted; despite the fact that persons high in administration circles, as well as members of Congress, have been and are talking of an emergency revenue bill which will take in for added taxation almost everything from needles and pins, tooth picks, tooth paste, etc., up to automobiles, motion picture films, and other larger articles of manufacture.

An emergency revenue measure would mean almost certainly a special session of Congress, it is believed. This most of the leaders are hoping to avoid.

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J. W. Brown, Lamp Maker, Dead

COLUMBUS, OHIO, Dec. 30—John W. Brown, president of the John W. Brown Mfg. Co., maker of automobile lamps, etc., died at his late residence at the age of 87 years. He was born in Pittsfield, Mass., and at the age of 29 went to California in the gold rush. On his return he stopped at Columbus and entered business with an uncle. For a score of years he was in the railroad business in various capacities. In 1888 he purchased a lamp-manufacturing plant formerly conducted by Henderson, Harper & Hayden, and from that point developed a large automobile lamp business. Several years ago a large plant was erected on Marion Road.

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Buda Motor Sued by Brandenburg for Alleged Breach of Contract

CHICAGO, Jan. 2—Brandenburg & Co., exclusive sales agent for various automobile components and parts, has filed suit against the Buda Co., Harvey, Ill., for alleged breach of contract under which Brandenburg & Co. have acted as exclusive sales agents for Buda motors since October, 1911. The suit filed asks for damages suffered and an accounting according to the terms of the sales contract.

In the suit filed Brandenburg & Co. state that their contract was for a period of years, but that on July 15, 1916, Buda refused to give them further instructions with regard to motors and notified all customers that Brandenburg & Co. no longer represented them. Brandenburg & Co. have tried to carry out the original contract but have been persistently refused recognition as exclusive representatives. In the suit Brandenburg states that the contract was to be terminated by mutual consent July 1, 1917, but that the Buda Co. undertook through a written notice to terminate the contract July 1, 1916, a year in advance. Suit has been filed in the Circuit Court of Cook County.

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Paige Has $5,000,000 Orders

DETROIT, Dec. 28—The Paige-Detroit Motor Car Co. has already received orders for 1917 for cars which amount close to $5,000,000.

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Belmont Motor Co. Organized

TOLEDO, Dec. 28—The Belmont Motor Co. has been incorporated with a capital of $125,000. Incorporators include A. T. Wilson and R. W. Beaschler.

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Marion Truck Corp. Formed

MARION, IND., Dec. 30.—The Marion Truck Corp with headquarters in this city has been incorporated with a capitalization of $1,000,000 to manufacture motor vehicles. The directors of the company are C. G. Barley, J. W. Stephenson, S. W. Winder, and G. C. Harwood.

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3000 Monitors for 1917

COLUMBUS, OHIO, Dec. 30—The Monitor Motor Car Co., this city, plans to produce 3000 cars during the coming year, and the plant on Mount Vernon Avenue is being enlarged and equipped accordingly.

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Buick Protests Car Order

FLINT, Dec. 29—W. H. McLeod appeared before the Interstate Commerce Commission at Washington, D. C., and protested against the issue of an order requiring the Buick Motor Co. to return to the owning roads within 30 days all cars in the possession of other roads. He stated that such an order would produce a confusion that would force many of the factories to close because of the sudden withdrawal of cars on which the movement of the output is dependent.

—

Wright Truck Attachment To Move

KANSAS CITY, MO., Dec. 30.—The Wright Truck Attachment Co., now located in Seattle, Wash., will remove to Kansas City, Mo., where a new factory will be started within ninety days.

—

Rocap Is King Sales and Service Eng'r

DETROIT, Dec. 30—I. D. Rocap has been made sales and service engineer of the King Motor Car Co. Mr. Rocap has been technical expert for the King company for some time.

Warnola Mfg. Co. Formed

Will Manufacture the Warnola Warning Signal—Name Decided by Contest

NEW YORK, Dec. 30—Warnola has been chosen as the name of a new automobile warning signal which is to be placed on the market by the Warnola Mfg. Co. of New York.

The name Warnola was chosen through a contest resulting from an advertisement which was run once only in THE AUTOMOBILE, *Motor Age* and *Motor World*. A prize of $25 was offered for the best name and it was won by Arthur Hirshon, an advertising man with the Ewing & Miles advertising agency.

—

Pullman in Friendly Receivership

YORK, PA., Dec. 28—The Pullman Motor Car Co., this city, has gone into temporary receivership, which is reported to be a friendly action of the stockholders and creditors taken as a means toward the rehabilitation and further development of the plant. This action was considered necessary owing to large expenditures for raw material in anticipation of factory requirements which were expedient in order to insure deliveries and take advantage of the low prices prevailing at that time.

During the past 2 years the sales of the company have increased too rapidly for the capital invested, and it was considered advisable to ask the local court to appoint receivers. Accordingly, W. A. Keyworth, a director, C. L. Hoff, president of the company, and H. D. Schmidt, chairman of the board, filed a bill in equity showing company assets totaling $925,000 and liabilities of $515,000; that the company did not have sufficient ready cash to meet the demands of certain insistent creditors, and that the assets were in danger of being impaired by suits and judgments.

There are on the books of the company contracts from dealers for more than 10,000 1917 models. The company did a business of $2,800,000 in 1915 and more than $3,300,000 in 1916. The appointment and authority of the temporary receivers is limited until Feb. 5, 1917, when a hearing of motion to continue these receivers as permanent receivers will be made.

—

Corbitt Truck Buys Automobile Co.

HENDERSON, N. C., Dec. 29—The Corbitt Motor Truck Co., has been formed with $1,000,000 capital to take over the Corbitt Automobile Co., this city. This company started the manufacture of automobiles 7 years ago, but after 3 years commenced the manufacture of trucks. As it has discontinued manufacturing automobiles altogether, it was thought best to change the name.

The company makes a line of trucks ranging from ¾ to 5 tons, all worm-drive. Up to the present time it has concentrated its sales in a local way around in the South, but now that new capital has been added, it will enlarge its territory to include New York, Boston and Chicago. The production will amount to 1200 or 1500 trucks a year.

—

Clark Mfg. Co. Combines Celfor and Buchanan Cos.

BUCHANAN, MICH., Dec. 28—The Celfor Tool Co., and the Buchanan Electric Steel Co., this city, will be taken over by the Clark Mfg. Co., a new corporation organized for that purpose. The merger is solely for the purpose of strengthening both companies.

There will be no change in the manufacturing or selling methods of either company and the personnel of the organization will be the same. The new company will be capitalized at $2,000,000 preferred and $3,000,000 common.

—

Packard Has Special Freight Arrangement

DETROIT, Dec. 29—The Packard Motor Car Co. has made special arrangements with custom officials of Canada to permit it to make shipments of Packard cars from Windsor, Ont., directly across the Detroit River from Detroit. The company has also rented twenty-six freight cars that are used in summer for carrying race horses. These cars are privately owned and are in consequence to be used only for Packard shipments and are returned to the factory as soon as they are unloaded.

—

Laidlaw Co. in New Building

NEW YORK, Dec. 30—The Laidlaw Co., Inc., has taken possession of its new six-story building at 16-18 West Sixtieth Street. Every detail of equipment for the manufacture of top materials and inclosed body linings has been installed.

—

Seiss Horn Buys Factory

TOLEDO, Dec. 28—The Seiss Mfg. Co., this city, maker of the Seiss horn, has purchased a factory on Lake Shore Avenue, with 52,000 sq. ft. of space. The new building affords an expansion of about triple the size of its present building. Operations will be transferred to the new building about Feb. 1.

—

3,500,000 Goodyear Tires in 1916

AKRON, Dec. 28—The Goodyear Tire & Rubber Co., this city, produced 3,500,000 tires in 1916.

Grant Co. in New Plant

Is Making Deliveries—Has More Than $1,000,000 Worth of Parts

CLEVELAND, Dec. 30—The Grant Motor Car Corp., formerly of Findlay, Ohio, is now occupying its new plant in this city and is making deliveries of its product from these quarters. More than $1,000,000 worth of parts are in stock, and the company plans, with its added facilities, to turn out seventy-five cars per day, or 20,000 cars a year.

The new plant includes three units; assembly, stock and paint shop. The assembly room is equipped with the latest model of cable conveyor which is approximately 500 ft. long, and is so arranged that the stock room in the center unit, is of easy access. Stock is carried in huge steel bins which are constructed in rows twelve high and thirty-two in number. A new and large electric oven has been installed to bake enamel on the frames. The paint shop is furnished with ten ovens which have a capacity for 140 bodies. All painting is done by the spray and splash systems.

The new factory is 250 ft. by 600 ft. and has 570 employees within its walls. Freight tracks are laid to run around two sides of the structure and give the company facilities for loading thirty cars at one time. The expansion of the concern is easily shown by comparison of figures for this and the preceding year. In 1915 the factory included three buildings in Findlay with a floorspace of 70,000 sq. ft. and a force of 300 workers. To-day, there are 570 employees and the new plant contains 155,000 sq. ft. Seven additional acres of land adjoining the factory, have been purchased to provide space for more buildings as growth demands.

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Bonus for Teetor-Hartley Employees

INDIANAPOLIS, Dec. 30—J. H. Teetor, president of the Teetor-Hartley Motor Co., of Hagerstown, Ind., last week announced a plan whereby bonuses will be distributed to the company's 300 employees in the near future. The amount of the employees' dividend will be $5,700.

—

Firestone Employees to Get Stock

AKRON, OHIO, Dec. 31—The Firestone Tire & Rubber Co., this city, has announced a plan in which every employee will be the object of a stock distribution plan. According to the scheme a sufficient number of shares of the common stock of the company has been set aside for their benefit. Employees whose

length of continuous service with the company is less than 6 months are entitled to 1 share; 6 months and less than 1 year, two shares; 1 year and less than 3 years, four shares; 3 years and less than 4 years, six shares; 4 years and less than 5 years, eight shares; 5 years and over, ten shares.

The stock may be purchased for cash, part cash and part deferred payments or all deferred payments. The price will remain at $100 per share until March 1, 1917.

—

Bonuses for Rex Ignition Salesmen

NEW YORK, Dec. 30—During the annual salesmen's convention of the Rex Ignition Mfg. Co., Jan. 3-5, bonuses will be distributed to the leaders in sales for the year. Meetings of the sales staff and distributers will be held twice daily, with entertainments in the evening. A theater party is scheduled for Jan. 5.

—

Bowser Employees Get Bonuses

DETROIT, Dec. 29—The S. F. Bowser company will give on Jan. 10, to every employee whose salary is less than $2,000 yearly, a bonus of 12½ per cent of the entire salary for the year of 1916.

The company states that the bonus is given because of the high cost of living and the concern's vast prosperity. The business for 1916 totaled more than $6,000,000 and the outlook for 1917 seems to be even greater. Many new buildings and considerable additional machinery installation are planned.

—

Moreland Gives Bonus

LOS ANGELES, Dec. 30.—The Moreland Motor Truck Co. will give its 234 employees a bonus of 10 per cent of their salaries. The bonus will be given on Jan. 1 to all workers who have been with the company for 6 months and will later be given to those whose services are under the 6 months' period when they have completed that length of service.

Motor Service Co. Formed

Owners of Klaxon, Remy and Delco Equipment to Get Factory Service

CHICAGO, Dec. 30—Car owners using Delco, Remy and Klaxon electrical equipment will get what practically amounts to factory service at home through the establishment of the Motors Service Co., 2641 South Michigan Avenue, which is under contract with the Dayton Engineering Laboratories, Dayton, Ohio, Remy Electrical Co., Anderson, Ind., and the Klaxon Co., Newark, N. J., to render the same grade of service as the car owner would get direct from the factory. W. C. Boulcott formerly assistant service manager for Delco is at the head of the newly-formed Motor Service Co., and L. C. Borel, former manager of the Remy branch here is assistant service manager. The Remy branch has been discontinued to make room for the Motor Service Co., which started business Dec. 18.

—

Vacuum Oil Grants Bonus

ROCHESTER, N. Y., Dec. 31—The Vacuum Oil Co., this city, has granted additional compensation to many of its employees. All salaried workers receiving not more than $300 a month are benefited. The compensation is on a sliding scale of percentages, from 5 to 25 per cent of the yearly salary received. The action is of further interest in that it coincides with the celebration of the fiftieth anniversary of the company, which was founded by Hiram B. Everest Oct. 4, 1866

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2750 LaCrosse Tractor Contracts

LACROSSE, WIS., Dec. 30—The LaCrosse Tractor Co., the recent consolidation of the Happy Farmer Tractor Co., Minneapolis, and the Sta-Rite Engine Co., LaCrosse, Wis., signed contracts to deliver 2750 tractors during 1917 to the thirty-one jobbers from nineteen States and Provinces who attended the first annual sales convention at LaCrosse. The average price is $650. The company's immediate capacity is 2500 tractors per annum, and it will either provide additional production facilities at once or make contracts with other shops for surplus output. In addition to the 2750 machines already contracted for, the company has nearly 100 orders for export shipment and a miscellaneous lot of orders in the United States, while the regular jobbers' orders cover only the minimum requirements for the new year, so that it is practically certain that the first year's production will be in excess of 3000 tractors. The machine will be trade-marked the Happy Farmer, and is a general utility tractor. B. F. Hamey, formerly of Minneapolis, is president and general manager of the new company.

—

Firestone to Rust-proof Rims

DETROIT, Dec. 28—The Parker Rust Proof Co. has received 10,000 rims, to be treated with its process, from the Firestone Tire & Rubber Co., and will deliver these rims to the Hupp Motor Car Corp. It is stated that this work is preliminary to the installation of a plant at the rim factory of the Firestone company for the rust-proofing of its rims.

—

Hollier Employees Receive Insurance

DETROIT, Dec. 28—Employees of the Lewis Spring & Axle Co. of Chelsea, Mich., were given life-insurance policies totaling more than $250,000 by the concern for Christmas presents. The premiums on the policies will be paid by the company as long as the men are in its employ. Those workers with a service record of more than 6 months received $1,000 policies and those under 6 months received $500, which will automatically increase to $1,000 after the men have been with the company 6 months.

New factory buildings of the Grant Motor Car Corp. in Cleveland. Production is now well under way

Best Service from Automobiles

Transportation of Passengers by Motor Vehicles Ahead of Railroads

NEW YORK, Jan. 2—Automobiles are giving a greater passenger transportation service than the entire steam railroad system of the United States or all the urban and interurban electric roads, according to Alfred Reeves, in his address at the highway engineering meeting last Thursday held by the American Association for the Advancement of Science. In support of his statement, figures were quoted showing that the steam railroads carried 1,053,000,000 passengers in 1914, with little increase in 1916, an average distance of 33.6 miles, or a total of 35,250,000,000 passenger-miles, and earned a revenue of $700,400,000 on this service. By comparison, the 3,250,000 passenger automobiles now registered in this country, averaging 5000 miles a year and three passengers per car, gave a service of 48,750,000,000 passenger-miles, worth $975,000,000 on the railroad basis of 2 cents per mile, or $200,000,000 more than the railroad passenger service.

The street and electric railroads carried 9,500,000,000 passengers in 1912 (the latest year for which official figures were at hand). The average distance traveled was 4 miles, making 38,000,000,000 passenger-miles. This produced a little more than $500,000,000, averaging 1 1/3 cents a mile. At this rate of fare the automobiles rendered a service this year of $598,500,000, or $98,500,000 more than the street railways.

Mr. Reeves further said that the 250,000 commercial vehicles in the country, averaging 50 miles a day, half the distance with average load of 2 tons, give a total of 3,750,000,000 ton-miles annually. Taking 20 cents per ton-mile as a fair average cost of hauling by horse-drawn vehicle on the public roads, this is worth $750,000,000 a year.

Thus the total passenger and freight service given by motor vehicles is worth $1,725,000,000 a year.

—

Nutt Retires from Velie

MOLINE, Ill., Dec. 28—L. E. Nutt has resigned from the Velie Motors Corp., this city. He has been connected with this company for 15 years and has been for the past 4 years in direct charge of purchasing and materials for the Velie interests. He was also a director in all the Velie companies and secretary of the Motor Vehicle and Engineering companies. His plans for the future have not been announced as yet.

—

Weber Resigns from Maxwell

DETROIT, Dec. 28—Orlando Weber, vice-president of the Maxwell Motor Car Co., Inc., resigned yesterday.

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Willard Battery Promotes Gribbon

DETROIT, Dec. 30—P. H. Gribbon has been appointed retail branch manager at this city for the Willard Storage Battery Co., in which capacity he has charge of all the retail sales in Michigan and a portion of Ohio.

—

Fetcher Resigns Managership

DETROIT, Dec. 28—M. B. Fetcher, general manager of the National Machine Products Co., has resigned and will shortly announce a new appointment.

War Dept. Trucks Cost $34,500,000

2300 Trucks Bought for Use on Mexican Border—Supplies Worth Millions

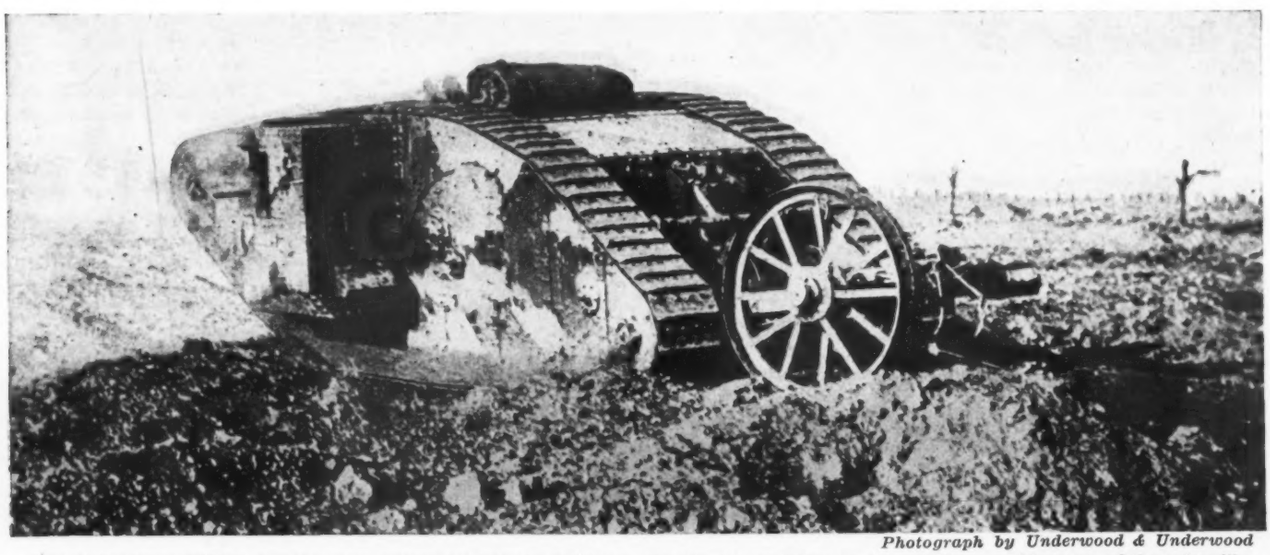
WASHINGTON, D. C., Dec. 30—According to information sent to Congress by the War Department in connection with estimates of appropriations, the expenses involved this year in the purchase and operation of motor trucks for transportation of the army and its supplies has amounted to nearly $34,500,000. The sum of $23,000,000 was appropriated in the last army appropriation bill for the present fiscal year, and an estimate of a deficiency appropriation of $11,415,700 has been submitted.

A great number of trucks were purchased for use on the border in connection with the operations of the regular army and national guard in the Federal service. A large number of trucks, which are not now in use, are stored at Fort Sam Houston, Fort Bliss and El Paso, Texas, where they are available for use as the occasion requires. About 2300 trucks were purchased and used along the border and in Mexico.

—

Brown Resigns from Scripps-Booth

DETROIT, Dec. 29—W. I. Brown has resigned as sales manager for the Scripps-Booth Co. to join the staff of the Harroun Motors Corp. Mr. Brown will assist J. J. Plath, director of merchandising, and R. Ward Macey, sales manager, until spring, when he will become a Harroun distributor in a large Middle West State.



Photograph by Underwood & Underwood

One of the huge British armored cars known as tanks in action on the front in northern France. These machines are of the caterpillar type, which feature enables them to crawl over trenches and shell craters which would prove unsurmountable barriers to ordinary armored cars. The tanks are also impervious to anything except a direct hit by a large-calibre gun. Note how the country is torn up by heavy artillery fire. This particular tank was photographed as it was bouncing over a shell crater.

M. & A. M. in Aero Exposition

Assn. Sanctions Participation of Members—Many Sell to Aeroplane Makers

NEW YORK, Dec. 31—For the first time in its history the Motor & Accessory Manufacturers' Assn. which includes in its membership more than 240 leading manufacturers of automobile and aeroplane accessories, has sanctioned its members exhibiting at a show or exposition outside of the annual national automobile shows in New York and Chicago. Yesterday, the association through its Board of Directors agreed to sanction the first Pan-American Aeronautics Exposition to be held in Grand Central Palace, Feb. 8 to 15, and a goodly number of its members will exhibit in a body in a large space set aside for them in an area of about 75,000 sq. ft. The exposition is to be held under the auspices of the Aero Club of America, the Pan-American Aeronautic Federation, and the American Society of Aeronautic Engineers.

The action of the Motor and Accessory Manufacturers is due to the fact that it realizes the important position aeronautics will occupy in American industrial life in the near future.

Many members of the M. & A. M. such as makers of carbureters, spark plugs, motors, motor parts, magnetos, electrical apparatus, etc., are already selling their products to the manufacturers of aeroplanes. That the aeroplane industry has reached a stage where it is bound to advance is appreciated by the M. & A. M. directors by the fact that the United States Government has recently appropriated $35,000,000 for the purchase of aeroplanes.

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Ford Dealers Cannot Stock Cars

DETROIT, Jan. 2—Dealers of Ford cars have been advised by the Ford Motor Co. that they will not be allowed to stock cars and that the company will only make shipments where actual orders and deposits have been secured.

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Dort Dealers and Distributors Meet

FLINT, Dec. 30—The Dort Motor Car Co. held its first annual sales banquet last night for its dealers and distributors. More than fifty-five of the largest dealers and distributors attended.

—

Nineteen More Bosch Contracts

NEW YORK, Jan. 2—The Bosch Magneto Co., this city, has signed contracts with nineteen companies in the automobile and truck field to use its magnetos for the coming season. They are as follows:

Thomas Evarts Adams, Inc., New York; Independent Auto Truck Co., Davenport, Iowa; Ben-Hur Motor Co., Willoughby, Ohio; Luverne Automobile Co., Luverne, Minn.; Chandler Motor Car Co., Cleveland, Ohio; Drexel Motor Car Corp., Chicago, Ill.; Lewis-Hall Iron Works, Detroit, Mich.; Hahn Motor Truck & Wagon Co., Hamburg, Pa.; Available Truck Co., Chicago; G. A. Schacht Motor Truck Co., Cincinnati, Ohio; Wichita Falls Motor Co., Wichita Falls, Tex.; McFarlan Motor Co., Connersville, Ind.; Durable Dayton Truck Co., Dayton, Ohio; United States Motor Truck Co., Cincinnati; W. W. Shaw Livery Co., Chicago, Ill.; Harroun Motors Corp. of Michigan, Wayne, Mich.; O. Armleder Co., Cincinnati; Baker, R. & L. Co., Cleveland, and Krebs Commercial Car Co., Clyde, Ohio.

—

Blames Dealer Allotment Schedules

DETROIT, Dec. 29—R. C. Rueschaw, sales manager of the Reo Motor Car Co., has issued a statement in which he attributed the freight car congestion, in great part, to the shipment of cars on dealers' allotment schedules. He states that frequently dealers are unable to make the payments for these cars, which are consequently held in the freight cars, thus keeping them from being emptied.

—

Forscier Increases Capital to $50,000

DETROIT, Jan. 2—The Forscier Motor Truck Mfg. Co., New Orleans, has increased its capital to $50,000 and will shortly build a factory.

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Ford Winnipeg Assembly Begins

DETROIT, Jan. 2—The Ford branch at Winnipeg started assembly in December. The business at the plant has increased over 400 per cent since Aug. 1, 1916.

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Smith Joins Hal Staff

DETROIT, Dec. 29—F. H. Smith has been appointed general representative of dealers for the Hal Motor Car Co. Mr. Smith was formerly assistant sales manager for the Chalmers Motor Co.

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Anderson Joins Eisemann

BROOKLYN, N. Y., Dec. 30—F. W. Anderson, who was formerly assistant chief engineer of the Remy Electrical Co. and previous to that a designing engineer with the Dayton Laboratories, has become associated with the engineering department of the Eisemann Magneto Co.

—

Canis Manages New Era

DETROIT, Jan. 2—W. B. Canis has been appointed treasurer and manager of the New Era Spring & Specialty Co.

—

Barker Resigns from Palmer-Moore

SYRACUSE, N. Y., Dec. 31—R. M. Barker has resigned as advertising manager of the Palmer-Moore Co., this city, with which he has been for the past 3 years.

$232,000 Profit for Portage

Earns 16% on Outstanding Stock in 1916—Gain in Gross Sales Was 75%

BARBERTON, OHIO, Jan. 3—Net profits of $232,000 equal to 16 per cent on the outstanding stock, are reported by the Portage Rubber Co., this city. The gain in the gross was 75 per cent and the net profits were 81 per cent over the former year.

Business during 1916 was 300 per cent above 1915, and the 1917 output is expected to double 1916.

B. J. Wildman, former manager of the Chicago office of the company, has been elected secretary, succeeding W. J. Anderson.

—

Ajax Purchase of Racine Rubber Ratified

NEW YORK, Dec. 29—The purchase of the Racine Rubber Co., Racine, Wis., by the Ajax Rubber Co., this city, has been ratified at a special meeting of the stockholders of the latter company. The increase in capital of the Ajax company to $10,000 was authorized. The formal closing of the purchase of the Racine company will be consummated as soon as the accountants' and appraisers' reports are completed and the figures verified.

—

Gibson Conference Closes

INDIANAPOLIS, Dec. 30—The Gibson Co., Indiana Overland distributor and accessory dealer, closed this week its annual 4-day conference of members of its accessory department and manufacturers of accessory goods handled by the company.

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Nelson Car Shown in New York

NEW YORK, Jan. 2—The car manufactured by E. A. Nelson will be shown at R. G. Neighbor's store at 1800 Broadway. There will be a chassis and sedan on exhibition, and demonstrations will be made.

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Saxon Dinner in New York Jan. 10

NEW YORK, Jan. 3—The Saxon company will give a dinner Jan. 10 at the Biltmore to its dealers. Harry Ford will be the main speaker.

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32,000 Ford Employees at Work

DETROIT, Jan. 3—Ford employees numbering 32,000 returned to work to-day.

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Johnson Stop-Squeak Oil on Market

RACINE, WIS., Dec. 28—S. C. Johnson & Son, this city, maker of the Johnson carbon remover, prepared wax, and other preparations for automobiles, has

brought out a new product called the Johnson Stop-Squeak Oil, especially applicable to springs, shackle bolts, body, fenders, top, etc. This oil is featured by its penetrating qualities as it will seep rapidly between the spring leaves, driving the rust before it and leaving a thin layer of grease between the leaves.

—

Make-a-Tractor Now Marketed

DETROIT, Jan. 2—The E. G. Staude Mfg. Co., St. Paul, Minn., is marketing a Make-a-Tractor which turns Ford, Overland and other cars into farm tractors.

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Steel Products Office Moved

DETROIT, Jan. 3—The local office of the Steel Products Co. will be moved to the Michigan Welding Co. plant on Feb. 1. R. T. Middleton has charge of the Michigan sales for the Steel Products Co., and will also take charge of the Michigan Electric Welding sales.

—

Cotta Capital Now $100,000

ROCKFORD, ILL., Dec. 30—The Cotta Transmission Co., this city, has increased the capital stock from $40,000 to $100,000, due to increased business. The old plant on South Main Street, has been abandoned and a new plant opened.

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Gasoline Higher in Chicago

CHICAGO, Jan. 2—The Standard Oil Co. of Indiana has advanced the price of gasoline 1 cent a gallon throughout its entire territory. The local price now is 18½ cents a gallon, tank-wagon basis.

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Hoover Steel Ball Increases Capital

DETROIT, Jan. 2—The Hoover Steel Ball Co. of Ann Arbor has increased its capital from $500,000 to $1,800,000.

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Simmons-Chalmers Co. Gets Ohio

CLEVELAND, Jan. 2—The Chalmers Motor Co. has appointed the Simmons-Chalmers Co. as the Chalmers dealer and distributer for this city and Ohio, succeeding the Logan-Fischer Motor Co.

292,300,000 Bbl. Petroleum

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Compares with 281,104,104 in 1915 and 265,762,535 in 1914

WASHINGTON, D. C., Dec. 30—Preliminary estimates by John D. Northrop, of the United States Geological Survey, indicate that the quantity of crude petroleum produced and marketed in the oil fields of the United States in 1916 was 292,300,000 bbl. This quantity is greater by 4 per cent than the corresponding output in 1915, which reached the record-breaking total of 281,104,104 bbl. Northrop estimates that 38 per cent of the 1916 total came from the Oklahoma-Kansas field, 30 per cent from California, and the remaining 32 per cent from the Appalachian, Lima-Indiana, Illinois, North Texas, North Louisiana, Gulf Coast and Rocky Mountain fields.

Mr. Northrop, in connection with an interesting table dealing with petroleum marketed in the United States during the 1859-1915 period, in barrels of 42 gal., shows production by states during that period as follows:

Pennsylvania and New York, 762,906,696 barrels; Ohio, 440,587,330 barrels; West Virginia, 269,497,613 barrels; California, 827,865,094 barrels; Kentucky and Tennessee, 9,533,244 barrels; Colorado, 10,857,618 barrels; Indiana, 103,699,558 barrels; Illinois, 251,368,311 barrels; Kansas, 57,725,079 barrels; Texas, 228,742,082 barrels; Missouri, 86,977 barrels; Oklahoma, 533,394,201 barrels; Wyoming, 12,210,469 barrels; Louisiana, 108,086,972 barrels; United States, 3,616,561,244 barrels. Total value, $2,971,388,126.

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Hamilton Motors Co. Incorporated

DETROIT, Jan. 2—The Hamilton Motors Co. of Grand Haven, Mich., has been incorporated for $500,000.

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Copper Lower—Oils Higher

NEW YORK, Jan. 3—Last week's market activities were featured with the usual demand and a drop in several of the metal prices and a rise in crude petroleum. Copper has continued its decline this week, and has reached 30 cents a pound, a drop of 1 cent. Antimony has dropped ¾ cent a pound to 13¼ cents, and lead is now quoted at $7.55 per 100 lb., a decline of 5 cents. Tin, on the other hand, rose last week to $42 per 100 lb., a net gain of $1.50.

The highest price ever quoted for Pennsylvania crude oil was announced last Friday by the principal purchasing agencies, when through an advance of 10 cents a barrel the quotation reached $2.85. Other grades, including Kansas crude petroleum, also rose. Kansas crude rose 10 cents a barrel to $2.85. The advance was caused by the continued demand of refiners, who insist there is an abundance of oil above ground, but producers are holding it for still higher prices.

In line with the present rise of tire prices comes a further rise in Ceylon rubber to 79½ cents a pound, a gain of 4 cents for the week.

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Prest-O-Lite to Boost Capital

INDIANAPOLIS, IND., Dec. 31.—The Prest-O-Lite Co., this city, has voted to increase its capital from 80,000 shares of no par value to 100,000 shares of no par value.

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Maibohm Offers Stock at $9

DETROIT, Jan. 2—The Maibohm Motors Co. of Racine, Wis., is offering its stock to the public at $9 per share, par value $10.

—

Pyrene Common Stock Tripled

NEW YORK, Jan. 2—The Pyrene Mfg. Co. to-day voted to increase the common stock from 100,000 shares to 300,000 shares, par value $10 each, making the total authorized capital of the corporation $3,050,000, of which $50,000 is preferred stock.

The stockholders further authorized the offering of 50,000 shares of the increased common for subscription at par pro rata to the stockholders of record on the day following the filing of a certified copy of the amended certificate of incorporation.

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Harroun Receives $425,516 for Stock

DETROIT, Jan. 2—The Harroun Motors Corp. received $425,516 from the sale of its stock to underwriters up to Dec. 14, 1916. It has cash on hand and in the bank amounting to $130,978 and cash deposited to the credit of a building fund amounting to $122,153. Machinery equipment to Dec. 14 cost $22,559. More than 6000 people have subscribed for the company's stock.

Ray Harroun states that contracts for car materials and parts have been entered into which will allow the company to ship demonstration cars by March, 1917, and to cover 46 per cent of the material requirements for the entire 1917 season.

The company has made an advance

Daily Market Reports for the Past Week

Material	Tues.	Wed.	Thurs.	Fri.	Sat.	Mon.	Week's Ch'g's
Aluminum, lb.	.60	.60	.60	.60	.60	.60	...
Antimony, lb.	.14	.14	.14	.14	.14	.13¼	—.00¾
Beams and Channels, 100 lb.	3.62	3.62	3.62	3.62	3.62	3.62	...
Bessemer Steel, ton	60.00	60.00	60.00	60.00	60.00	60.00	...
Copper, Elec., lb.	.31	.30	.30	.30	.30	.30	— .01
Copper, Lake, lb.	.31	.30	.30	.30	.30	.30	— .01
Cottonseed Oil, bbl.	12.55	....	12.19	11.95	11.95	11.93	— .62
Cotton, Egyptian	.40	.40	.40	.40	.40	.40	...
Cotton, Sea Island	.52	.52	.52	.52	.52	.52	...
Fish Oil, Menhaden, Brown, gal.	.72	.72	.73	.73	.73	.73	...
Gasoline, Auto, bbl.	.22	.22	.22	.22	.22	.22	...
Lard Oil, prime, gal.	1.30	1.30	1.30	1.30	1.30	1.30	...
Lead, 100 lb.	7.60	7.55	7.55	7.55	7.55	7.55	— .05
Linseed Oil, gal.	.93	.93	.93	.93	.93	.93	...
Open-Hearth Steel, ton	60.00	60.00	60.00	60.00	60.00	60.00	...
Petroleum, bbl., Kans., crude	1.30	1.30	1.40	1.40	1.40	1.40	+ .10
Petroleum, bbl., Pa., crude	2.75	2.75	2.75	2.85	2.85	2.85	+ .10
Rapeseed Oil, refined, gal.	1.00	1.00	1.00	1.00	1.00	1.00	...
Rubber, Fine Up-River, Para, lb.	.79	.78	.78	.78	.78	.78	— .01
Rubber, Ceylon, First Latex, lb.	.75½	.78	.78½	.79	.79	.79½	+.04
Sulphuric Acid, 60 Baume, gal.	1.50	1.50	1.50	1.50	1.50	1.50	...
Tin, 100 lb.	40.50	40.50	40.63	42.00	42.00	42.00	+1.50
Tire Scrap, lb.	.06½	.06½	.06½	.06½	.06½	.06½	...

payment of $2,000 for the property known as the Prouty & Glass plant at Wayne, and has paid $63,000 for a site for a manufacturing plant, now under construction, in Wayne, besides contracting for a progressive type assembly plant and machine shops to cost approximately $400,000.

The statement in full to Dec. 14, 1916, is:

Real estate, actual cost	$61,300
Account Prouty & Glass Plant	2,000
Cash payments to date on plant under construction	45,415
Machinery equipment	22,559
Detailed working materials, tools, dies, patterns, purchase of material at actual cost for finishing first group of cars	21,117
Paid for account of dies	6,000
Advertising in trade papers and printing	7,102
Stationery, registration fees, certificates, traveling expenses, office rent, salaries of clerks in New York	5,659
Cash deposited to credit of building fund	122,153
Cash on hand and in banks	130,978
	$425,516

New Hayes Stock at $12

DETROIT, Dec. 29—The 62,000 shares of new $10 par value common stock of the Hayes Mfg. Co. to be issued after Jan. 1, as a result of the approval of the reorganization plans by the stockholders this week, will come on the market at about $12 a share.

The new common stock will pay 12 per cent a year, the first quarterly dividend of 4 per cent to be paid March 31.

Detroit Club Has Show Train

DETROIT, Dec. 28—The new Detroit Automobile Club has arranged for a special train to the New York show, Jan. 7.

Security Prices Are Higher

Peace Developments Have Good Effect on Quotations, Which Are Steady

NEW YORK, Jan. 3—Increased strength marked yesterday's activities on the Stock Exchange and Curb market. Up to that time automobile and accessory issues were in small demand, with low prices. A few of the tire issues have managed to hold strong, notwithstanding outside pressure, such as the recent break in the market on the peace report. Fisk, Firestone and United States Rubber were active, with substantial gains. Fisk common and preferred rose 5 and 3 points respectively, Goodrich preferred went up 1 point and United States Rubber common and preferred rose 1¼ and ½ points.

General Motors chalked up its usual 100-point gain, closing on Friday at 600. It is stated that this company will earn over 40 per cent on the new common.

Ford Tractor Co. of Minneapolis Offers Stock to Public

NEW YORK, Jan. 2—The first public offering of its shares has been made by the Ford Tractor Co., Minneapolis, Minn., maker of the Ford tractor, selling at $495. This company is engaged exclusively in the manufacture of farm tractors and has no connection with the Ford Motor Co., Detroit.

The company is incorporated with a capital of $10,000,000, divided into 100,000 shares of 7 per cent preferred and 900,000 shares of common. Each share has a par value of $10. Robert P. Matches & Co., this city, are offering for subscription 50,000 shares of the common at $4 per share, par $10.

Dividends Declared

Spicer Mfg. Co., 2 per cent on first and second preferred, payable Jan. 1 to holders of record Dec. 23.

Smith Motor Truck Corp., initial dividend on preferred for period from Nov. 27 to Dec. 31 at rate of 8 per cent per annum and payable Jan. 15 to holders of record Dec. 31.

Joseph Dixon Crucible Co., extra of 20 per cent and regular semi-annual of 2½ per cent.

Selden Motor Truck Sales Co., semi-annual of 6½ per cent on preferred, payable on Jan. 2 to stock of record on Dec. 21.

Buffalo Show Opens Jan. 22

BUFFALO, N. Y., Dec. 29.—Buffalo's fifteenth annual automobile show will be held in the Broadway Auditorium Jan. 22-27, inclusive, under the auspices of the Buffalo Automobile Dealers' Association.

Assmus Returns from Cuba

DETROIT, Dec. 29—C. O. Assmus, of the foreign department of the Maxwell Motors Co., Inc., has returned from a business trip to Cuba.

Automobile Securities Quotations on the New York and Detroit Exchanges

	Bid	Asked	Net Ch'ge
Ajax Rubber Co.	72	73	— ½
J. I. Case T. M. Co. pfd.	86	90	..
Chalmers Motor Co. com.	30	33	—5
Chalmers Motor Co. pfd.	..	..	..
*Chandler Motor Car Co.	97½	99¼	— ½
Chevrolet Motor Co.	122	130	—3
Fisher Body Corp. com.	39	41	+2
Fisher Body Corp. pfd.	92	94	..
Fisk Rubber Co. com.	75	..	+5
Fisk Rubber Co. 1st pfd.	107	112	+3
Fisk Rubber Co. 2d pfd.	101	105	+11
Firestone Tire & Rubber Co. com.	140	145	+5
Firestone Tire & Rubber Co. pfd.	107	108	..
*General Motors Co. com.	600	800	+100
*General Motors Co. pfd.	120	125	..
*B. F. Goodrich Co. com.	59¼	59¾	— ½
*B. F. Goodrich Co. pfd.	111	112	+1
Goodyear Tire & Rubber Co. com.	280	287	—5
Goodyear Tire & Rubber Co. pfd.	106	108	—2¾
Grant Motor Car Corp.	6	7	—1
Hupp Motor Car Corp. com.	3	4	— ½
Hupp Motor Car Corp. pfd.	..	..	..
International Motor Co. com.	..	17	..
International Motor Co. 1st pfd.	..	80	..
International Motor Co. 2d pfd.	..	50	..
*Kelly-Springfield Tire Co. com.	60	61	+1½
*Kelly-Springfield Tire Co. 1st pfd.	93	95	—1
*Lee Tire & Rubber Corp.	27½	28	—2½
*Maxwell Motor Co. com.	47½	48	—5½
*Maxwell Motor Co. 1st pfd.	68	69¼	—4
*Maxwell Motor Co. 2d pfd.	34	37	—3
Miller Rubber Co. com.	..	250	..
Miller Rubber Co. pfd.	106	107	..
Packard Motor Car Co. com.	165	170	—5
Packard Motor Car Co. pfd.	99	102	—1
Paige-Detroit Motor Car Co.	39	40	—1
Peerless Truck & Motor Corp.	16	20	..
Portage Rubber Co.	170	179	—8
Regal Motor Car Co. pfd.	25	..	+2
Reo Motor Car Co.	39¾	40¼	—1¼
Saxon Motor Car Corp.	62	66	—3
Springfield Body Corp. com.	75	82	+5
Springfield Body Corp. pfd.	112	125	—3
Standard Motor Construction Co.	4½	5½	—1½
Stewart-Warner Speed. Corp. com.	97	99	..
*Studebaker Corp com.	103⅜	103⅞	— ⅜
*Studebaker Corp. pfd.	107⅜	108	— ⅛
Swinehart Tire & Rubber Co.	..	80	..
United Motors Corp.	45	46½	— ¾
*U. S. Rubber Co. com.	61¼	61½	+1¼
*U. S. Rubber Co. pfd.	112	114	+ ½
White Motor Co.	48	48¾	..
*Willys-Overland Co. com.	35	35¼	—2⅜
*Willys-Overland Co. pfd.	96	97	..

*At close Dec. 29, 1916. Listed New York Stock Exchange.

OFFICIAL QUOTATIONS OF THE DETROIT STOCK EXCHANGE

ACTIVE STOCKS

	Bid	Asked	Net Ch'ge
Auto Body Co.	..	47½	..
Chalmers Motor Co. com.	120	..	..
Chalmers Motor Co. pfd.	..	..	..
Continental Motor Co. com.	41	42¼	+1¾
Continental Motor Co. pfd.	9½	..	..
Ford Motor Co. of Canada	..	290	..
General Motors Co. com.	..	..	..
General Motors Co. pfd.	..	..	..
Maxwell Motor Co. com.	..	..	..
Maxwell Motor Co. 1st pfd.	..	..	..
Maxwell Motor Co. 2d pfd.	..	..	..
Packard Motor Car Co. com.	165	170½	..
Packard Motor Car Co. pfd.	..	..	..
Paige-Detroit Motor Car Co.	39¾	40	+ ½
W. J. Prudden Co.	49	51	..
Reo Motor Car Co.	39¾	40¼	+1¾
Studebaker Corp. com.	..	..	..
Studebaker Corp. pfd.	..	..	..
C. M. Hall Lamp Co.	29½	..	..

INACTIVE STOCKS

Atlas Drop Forge Co.	30	34	..
Kelsey Wheel Co.	55	60	..
Regal Motor Car Co. pfd.	25	..	..

The Automobile

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A Body Year?

PREDICTION is always a little unsafe, but there seems reason to believe that 1917 will see considerable changes in automobile bodies. In the past we have had changes in outline; changes in the shell that is, but there had been little alteration in seating proportions till 1916, and the convenience and comfort of bodies still leaves a great deal to be desired.

One conspicuous thing that most bodies lack is a sufficiency of places to put the impedimenta for short journeys. The door pocket is a miserable place for anything, yet it is usually choked with unconsidered trifles that are all necessary. When one is wanted the whole lot have to come out. There are seldom locked compartments for gloves and small wraps, yet one does not want these things when leaving the car. Even the always essential Blue Book has to be carried in some makeshift place where its covers are bent and its leaves disfigured.

There are the big things, too. The top which folds away into a compartment in the body is coming. It will last twice as long when thus protected. Side curtains are becoming more convenient and fit better when in use; windshields, even, are being improved so that they admit less draft and rain round the edges. These things which appear first on costly custom-built cars can all be turned into quantity production channels without making the stock body much more expensive. They are mostly a matter of getting the right idea in the first place. In the past the average automobile body has been built with total disregard of the fact that people never go automobiling without wanting to do so comfortably in all weathers and without carrying with them quite a large quantity of small articles. There is a change coming and its presence will be felt very strongly during the year that has just begun.

Improvement

THE outstanding characteristic of the 1917 automobile is its better mechanical detail. To all appearance a car may look the same as it did a year ago, but it is almost always a better car for some trivial reason. For example, crankshaft bearings are larger, on the whole. The lubrication systems are more carefully finished in such ways as the exact shape of the oil troughs. Higher power is got by getting better cylinder castings that are smoother in the valve ports and passages.

Many little fittings and accessories are more substantial. Last year the huge drop in price caused several manufacturers of the articles that are bought complete by the automobile makers to take a chance on some thin pressing standing up or on one screw doing the work of two. On the whole, the results have been good, but in a few cases the thing was overdone, and the job has had to be stiffened up again.

In brief, 1916 has been devoted to the perfection of the cars created during 1915, this covering both design and manufacture. The aluminum alloy piston was new to quantity production in 1915. There have been some troubles with it, and in 1916 these have been overcome completely. Twenty per cent of the cars listed now have engines with overhead valves. These used to be a source of trouble, especially noise, except when made with exceptional care. Now we have discovered how to make the valve-in-head type as easily and as well as any other.

The instances could be multiplied over and over, but there is no need. They are obvious to every close student of the American automobile. They make the 1917 car much better value for the price and they will be appreciated to the full by the user both at home and in all the countries of the world where the American automobile is penetrating.

Higher Truck Fees

HIGHER registration fees for commercial vehicles, as recommended by the special commission appointed to investigate the subject in New York State, would entail a tremendous burden on the motor truck and bus owners, and might even curtail sales of such vehicles. Nor must this movement be misconstrued as a merely local condition by the rest of the country, as if truck fees are increased in New York, it will not be long before other States take similar action.

As compared with the present flat rate of $5 in New York State, the proposed increase of from double to fourteen times that amount is a matter worthy the serious attention and vigorous opposition of commercial vehicle owners throughout the country.

The AUTOMOBILE

NEW YORK SHOW ISSUE

WORKMANSHIP

¶ In 1915 automobile design advanced an enormous stride; in 1916 automobile manufacture has advanced similarly

¶ In 1916 American automobiles have been better designed than ever; in 1917 they will be built better than ever

¶ In 1915 the engineering force of the industry did the best it knew how; in 1916 the factory staffs have followed the lead

A YEAR ago we chronicled an immense step forward in automobile design. We had seen, in 1915, almost every well-known car altered almost beyond recognition. We had seen the commencement and the rapid rise of new movements, of new ideas. In the year just past, there has been no such upheaval; there has been a pause in engineering work on the drafting board, while the processes of *manufacture* were advanced to keep step with the improved designs.

$1687 Average Price

The average list price of the 1917 open body automobile is $1687, $87 more than it was a year ago, $318 less than two years ago, $948 less than it was three years ago, when the zenith price of $2635 was reached. The enormous fall in average price in 1915 has been followed by a small rise, due partly to the abnormally high price of materials, but due also to some extent to the demand for rather better made and better finished cars. It seems that manufacturers having gone to the lowest possible prices are finding the public is willing to pay a little more for a little higher class job.

The 1916 automobile was the *best* car on the average that we had ever had, the 1917 car is better still, and the extra $87 buys increases in durability, reliability, convenience, and appearance.

Demand Exceeds Supply

In years to come the points on the price curve for this year and last will be extremely interesting. In the early summer of 1915 the period of slack trade following the commencement of the war in Europe had only just begun to give way before the era of prosperity which has followed. In July, 1915, few factories had more orders than they could fill; many had cars on their hands. Thus, if the increased demand of the fall of 1916 could have been foreseen, we might never have had the $1600 average price of a year ago. Yet to-day, when the demand is as strong as ever, when no manufacturer has any doubts about the disposal of the maximum his factory can produce, the rise has averaged only $87, and more quality of workmanship is being given. It means that even if the low water mark last January was an effect of the war panic, it was none the less a commercially proper price. There is no

thought whatever that it was too low to be reasonably profitable.

Before proceeding to a closer analysis of the 1917 cars, it is well to make quite clear the meaning of the averages therein discussed. These averages are determined by taking the number of makes and models obtainable on the American market of American made cars, giving each an equal value, whether the manufacturer produces a thousand or a million in a year.

Meaning of Average

Each car, as it is introduced, represents the idea of a group of men as to what a car should be. Each firm that chooses a four-cylinder engine, a unit power plant or whatnot, has cast its vote for that form of construction. Each firm, be it large or small, has as good a right to vote equally with another as has a citizen to vote for his choice of government, be he a millionaire or a laborer. Averages deduced from listed models do truly represent average engineering thought. High-grade cars produced in small quantities generally lead in engineering quality; cheap cars produced in huge quantities generally lag behind, so that the engineering opinion of the nation is seen most truly by the determination of averages by the listed models. To take account of production would make the Ford car, with a few modifications, the typical American automobile; would show that anything but four-cylinder engines were hardly worth considering; that the straight bevel was more favored than the spiral. In fact, averages based on production would give no idea whatever of the trend of engineering opinion. *Engineering opinion goes before production in quantity.*

Sixes Increase

Last year one of the most interesting developments was the V engine, with eight or twelve cylinders. At the start of 1916 there were but two V-engined cars on the market, and no twelves among them; by the end of the year there were sixteen eights and five twelves to choose among. To-day there are listed twenty-five models of eight-cylinder cars and seven different twelves. There are among the models included in THE AUTOMOBILE'S specification tables 63 fours, 81 sixes, 25 eights and 7 twelves, and these figures show that of the new cars added during the year there have been more sixes than anything else. Turning to the big curves on the supplement which is included in this issue, it will be noticed that there has been a slight percentage increase in sixes, and that the rapid fall in the popularity of fours has apparently been checked. The appearance is rather that four and six have found a level, at least for a time. The percentage variation in the number of sixes has really varied only quite a little since January, 1914. There is no sign whatever that the eight or twelve is likely to displace the six, rather may we regard the V-engine cars as additions than as substitutions.

This year there are listed in the tables 188 different chassis and 131 different manufacturers; the average number of chassis per maker thus being 1.43, which is the lowest figure yet reached; last year it was 1.56. The average car is smaller. Its wheelbase has shrunk from 119.5 in. last year to 113.25 in. Tires, too, have dropped from 33 by 4½ average a year ago down to 31.4, and engine displacement from 278.8 has sunk to 222.5 cubic inches. The formula horsepower is 24.3, instead of 28.6.

In all these things, as in many other smaller details, we can see the indications of last year's averages being carried steadily along. Few if any of the trends shown in the diagrams on the pages following have actually changed their direction.

Automatic Temperature Control

An important trend which does not show on the tabulations, because it is too new as yet, is that toward engine temperature control. Interest in this subject was forced on the industry by the lowering grade of gasoline and the importance of a proper degree of heat has been brought home to the motorist largely by means of the Boyce Moto-Meter, which is now fitted to a majority of the medium and higher priced cars, and added by the owners to many cheap machines. Thermostatic control for the water, started by Cadillac and continued by Packard, is gaining in favor, and Hudson has started the alternative scheme of an air shutter, hand controlled.

These things are in the same state now as the Stewart vacuum fuel feed was just after its introduction; they hardly show among general percentages, but it is incontestable that a year more will do for them the same as the first twelve months did for the vacuum feed; that is, thermostatic or similar heat control will be applied to most cars when the 1918 tabulations come to be made.

Barring this matter of temperature controlling, there has been no striking development or movement in 1916, unless it be toward more rigid frames. This trend, if it is to prove one, is just beginning, and the reason for so great a change in idea is that the car with an inflexible frame is thought to ride more easily on rough roads than a similar machine with a frame of a more elastic character. No doubt the Brush frame used on Marmons and Molines has drawn attention to frame design, and the 7 and 8 in. side rails now coming into use are an approach toward the Brush construction.

Driving Is Easier

Another very general improvement, which is not apparent in statistics, is in ease of control. Scarcely a manufacturer but has not done something to make his car easier to drive. Beginning with the most important thing, the setting of the front axle on the springs, so as to give the best degree of tilt to the steering knuckles, is being more considered, and needless friction in any part of the steering gear is being eliminated. Next in importance, the effort needed to apply the foot brake, or to release the clutch is smaller. Brakes have been made so that less travel of the lever is required to set them, and the leverage of the pedal has been increased. With clutches, more surface and more leverage gives lighter action.

This change is distinctly gratifying to the editorial staff of THE AUTOMOBILE, because poor steering and bad brakes have suffered plenty of criticism in these columns during the last 2 years.

Another distinct change for the better, for which THE AUTOMOBILE also intends to claim a trifle of the credit, is a general improvement in body proportions, particularly front compartments. The average man will be much more comfortable in the average 1917 automobile than he has ever been before; the driver, with better seating and easier controls, will find his mental and physical labors reduced to a quite substantial extent.

Many New Ideas

Never before, not even in the formative year of 1915, have there been so many new ideas under consideration and discussion. There is the vital problem of handling fuel that is practically kerosene; there is the desire to reduce weight and cost of operation; there is the probability of electric and other forms of flexible transmission. As lesser matters, none the less important, we have the balancing of engines, the carbonization trouble and a general dissatisfaction with many details such as brakes and controls. It has already been said that these last named are better this year, so is balancing, so is carburetion and so is lubrication, but the car of 1918 and that of the year following is going to be better still and perhaps very much better.

Fuel is the biggest problem the industry has ever had to face, and it is a really serious one. That is to say, it is not a matter of waiting for some solution to offer itself. It is up to the automobile industry either to use the fuel they can get or, conversely, to get the fuel they can use.

On the one hand engineers are doing their best with engines and carbureters to make them able to assimilate heavy oils successfully. On the other hand the commercial side of the trade is delving into processes for making light fuel from heavy, and even into the chances of establishing huge alcohol distilleries. No man living can forecast what will happen in the next ten years; we may have many new fuels or many new types of engine or, perhaps most probable of all, we may have both new fuels *and* new engines.

Much Talk of Electric Drives

Electric transmissions of several sorts are now being used by American manufacturers of passenger cars and trucks. So far there are no big productions in immediate contemplation, but it betrays no confidences to say that hardly one of our leading organizations but is experimenting with electric drive. Engineers think about, try and finally abandon many things; this may be a case in point, but many think that there will be no abandonment in this instance.

There are a vast lot of things to be settled before a manufacturer can take such a plunge as to give up anything so satisfactory as the gear drive. He has to be convinced very strongly that the new thing is utterly reliable, and he has to be satisfied that it is not going to be too costly. Then there is the question of supply and materials; finally the viewpoint likely to be adopted by the public. Thus it needs much more courage to use a new transmission than it took to adopt an eight-cylinder engine. Because of these things development must be slow, but it may be all the more sure.

Public More Exacting

The automobile buying public of 1917 is a vastly more critical one than that of 2 years ago. It is more critical of appearance, of comfort and of performance. This is a good deal because the public knows much more about automobiles than it used to do. A man who cannot talk about a car with some understanding is rather a rarity now, and this motor knowledge is not confined to the towns; in fact, it is the spread of machinery of all kinds into all lives that is making the people of the United States an essentially mechanical population; mechanical by instinct.

How great an effect demand has had in producing improvement and how great has been the effect of improvement is causing the public to demand still more, is a question that can never be decided, but the important thing is that there seems no chance whatever of reaching a standard type of automobile which will satisfy forever. As a matter of fact, the final, ideal car never seemed so far away as it does at present.

Wider Choice of Cars

Of types of car and types of chassis the American buyer has never had so wide a selection placed before him. It is easy to divide the field into price groups or cylinder groups or size groups, but these classifications, if made, would be far less defined than in any previous year. We have cars of all sizes at all prices. There are several new cars of small dimensions and very high price; there are many new cars of large dimensions and very low price. Between these extremes there is a steady progression. Perhaps interest concentrates particularly upon the cars costing from $1,000 to $2,000, as great variety is here apparent, but the cheaper vehicles have had a good deal of intensive work put into them and display much engineering skill.

The past year has been a good one for the high-priced cars, and the very costly jobs have been refined in many little details so that their luxury is greater than ever. The $5,000 car, however, no longer serves as a model for the cheap producer.

Supplement Shows Trends

On the 13 pages following the different portions of the 1917 cars are considered in greater detail. The diagrams used to illustrate the trends of engineering thought are precisely the same as those published last year, and in another part of the paper will be found a supplement printed in two colors, showing the trends in the most important matters. It may be mentioned that three things have been removed from this sheet this year, these being the proportions of right and left hand steering and the method of casting the cylinders. There are hardly any right steer cars left, and hardly any engines that do not have block-cast cylinders.

SIDE GUIDE & GRIPPER

Comparison of Average American Car for 8 Years

General Averages	1917	1916	1915	1914	1913	1912	1911	1910
Horsepower, S.A.E. rating	24.3	28.66	29.97	33.2	33.60	33.60	32.7	31.5
Bore	3.37	3.57	3.82	4.12	4.19	4.34	4.42	4.85
Stroke	4.66	4.97	5.10	5.28	5.15	4.97	4.46	4.68
Stroke bore ratio	1.38	1.39	1.33	1.28	1.23	1.09	1.01	1.03
Piston displacement	222.5	278.87	307.38	349	345	316.2	313.2	281.5
Wheelbase	113.25	119.56	122.19	121	122	121	114	112
Gear ratio	4.15-1	4.08-1	3.88-1	3.6-1	3.57-1	3.62-1	.....	.....
Tires	31x4	23x4½	34x4	35x4½	35x4½	35x4	34x4	34x4
Number cars	.....	519	535	607	.....	.....	.....	.....
Number chassis	188	176	200	236	339	381	393	364
Number makes	131	108	119	133	156	193	270	239
Price	$1687	$1600	$2005	$2635	$2585	$2508	$2560	$2214
PERCENTAGE								
Number of Cylinders								
One cylinder	0	0	0	0	0	1	1	5
Two cylinders	0	0	.5	1	1	1	2	3
Four cylinders	37	39.2	51.0	54	62	78	80	82
Five cylinders	0	0	0	0	1	1	0	0
Six cylinders	47	45.8	47.5	45	36	19	17	10
Eight cylinders	12	12.6	1.0	0	0	0	0	0
Twelve cylinders	4	2.4	0	0	0	0	0	0
Shape of Cylinders								
I cylinder type	20	13.7	16.5	30	31	30	22	20
L cylinder type (V motors	73	73.3	70.0	59	56	55	60	56
T cylinder type	5	13.0	8.5	6	9	9	14	18
Knight type	2	3.6	3.0	3	3	2	1	0
Two cycle	0	0	1.0	1	1	4	3	6
Mondex Magic type	0	0	0	1	0	0	0	0
Gasoline electric	0	1	0	0	0	0	0	0
Cylinder Arrangement								
Cylinders cast separate	.....	4.8	4.0	6	15	22	28	39
Cylinders cast in pairs	.....	10.2	27.0	42	48	58	60	53
Cylinders cast in block	.....	78.4	67.5	39	29	18	12	8
Cylinders cast in threes	.....	6.6	10.5	13	8	2	0	0
Cooling								
Air cooled	1	.6	.5	2	4	5	6	7
Thermo syphon	38	38.2	27	19	17	19	28	23
Pump circulating	61	61.2	72.5	79	79	76	66	70
Ignition Systems								
Single ignition	84	76.0	56	23	15	14	18	25
Dual ignition	9	19.2	36	59	68	63	53	40
Two spark ignition	1	1.2	1.45	4	2	0	0	0
Double ignition	3	1.8	4.55	11	15	23	29	35
Duplex ignition	3	1.8	2.0	3	0	0	0	0
Engine Lubrication								
Splash oiling	35	52.7	46.5	42	53	68	81	0
Splash pressure oiling	35	23.35	16	39	32	20	0	0
Oil in fuel	0	0	0	1	1	2	3	6
Pressure oiling	30	23.35	37.5	18	14	10	19	0
Splash gravity	0	.6	0	0	0	0	0	0
Engine Starting								
Electric starter	99	98.8	94.5	87	37	2	0	0
Acetylene starter	0	0	0	1	14	0	0	0

General Averages	1917	1916	1915	1914	1913	1912	1911	1910
Air starter	0	0	0	4	9	2	1	1
Optional starter	0	0	1.5	2	5	0	0	0
Mechanical starter	0	0	.5	1	4	0	0	0
No starter as stock	1	1.2	3.5	5	31	98	99	99
Fuel Feed								
Gravity fuel feed	18	31.8	57	58	65	75	81	82
Gravity pressure fuel feed	1	2.4	.5	1	0	0	0	0
Pressure fuel feed	7	12.0	22	41	35	25	19	18
Vacuum feed	74	53.8	20.5	0	0	0	0	0
Gas Tank Location								
In cowl	.....	No 1916	7.2	13	.....	.....	.....	.....
At rear	.....	figures	51.1	41	.....	.....	.....	.....
Under seat	.....	avail.	21.2	46	.....	.....	.....	.....
Type of Clutch								
Disk clutch	68	53.4	51	48	52	44	51	49
Cone clutch	30	45.6	44	41	45	52	47	39
Expanding band clutch	0	0	.5	3	1	3	2	6
Contracting band clutch	0	0	4.5	5	2	1	1	3
None	1	0	.....	3	.....	.....	.....	.....
Electric	1	1.0	.....	.....	.....	.....	.....	.....
Type of Gearset								
Selective	98	96.5	91.5	95	94	92	90	85
Progressive	0	1.7	3.5	1	2	5	1	8
Planetary	0.5	.6	1.0	1	1	2	4	4
Friction	1.5	1.2	2.5	3	3	1	5	3
Location of Gearset								
Amidship	14	20.6	32.5	39	46	55	67	75
Unit with axle	9	15.3	18.2	15	20	20	17	15
Unit with motor	77	63.5	49.3	43	34	25	16	10
None	.....	0	.....	3	.....	.....	.....	.....
Infinite	.....	.6	.....	.....	.....	.....	.....	.....
Steering and Control								
Right steer. right control	.....	6.8	9.5	24	58	70	81	93
Right steer. center control	.....	2.2	3	10	13	15	11	4
Left steer. center control	.....	87.1	79.5	57	25	13	6	2
Left steer. left control	.....	1.1	3.5	2	4	2	2	1
Optional steering	.....	2.8	4.0	4	0	0	0	0
Elec. gearshift (left steer.)	.....	0	0	3	0	0	0	0
Final Drive								
Shaft and bevel	28	41.0	84.5	93	94	92	91	89
Chain	1.5	1.7	4.5	4	4	6	8	11
Shaft and worm	0.5	.5	1.5	1	1	1	0	0
Roller	0	0	0	1	1	1	1	0
Shaft and spiral bevel	70	56.8	9.5	1	.....	.....	.....	.....
Type of Axle								
Floating	43.5	51.8	56.5	65	67	50	0	0
Semi floating	25.5	23.6	23.0	17	26	49	0	0
Three-quarter floating	29.5	22.8	18.5	14	4	0	0	0
Seven-eighths floating	0	0	0	1	0	0	0	0
Dead rear axle	1.5	.6	2.0	3	3	1	0	0
Timing Gear Drive								
Spur gear	4	8.4	16.1	13	83	.....	.....	.....
Helical or spiral gear	74	73.0	73.7	77	10	.....	.....	.....
Silent chain	21	18.1	9.1	10	7	.....	.....	.....
Worm	1	.5	1.1	0	0	0	0	0

Models Listed by Manufacturers for 1917, 1916 and 1915, Showing Changes in Proportion of Sixes, Fours and Other Engine Types

Car	VARIETIES OF ENGINE MANUFACTURED								
	1917			1916			1915		
Abbott		6			6	8	4	6	
Aland	4								
Allen	4			4			4		
American		6							
Ams Sterling	4								
Anderson		6							
Apperson		6	8		6	8	4	6, 6, 6, 6	
Arbenz	4			4			4		
Auburn		6, 6		4	6, 6		4	6, 6	
Austin			12						
Bell	4			4					
Biddle	4			4					

Car	VARIETIES OF ENGINE MANUFACTURED								
	1917			1916			1915		
Bour-Davis		6							
Brewster	4			4					
Briscoe	4			4		8	4		
Buick	4	6			6, 6		4, 4	6	
Cadillac			8			8			8
Cameron		6							
Case	4			4			4, 4, 4		
Chalmers		6, 6			6, 6, 6			6, 6	
Chandler		6			6			6	
Charter Oak		6							
Chevrolet	4		8	4, 4, 4, 4			4, 4		
Cole			8			8	4	6	

SIDE GUIDE & GRIPPER

Car	VARIETIES OF ENGINE MANUFACTURED								
	1917			1916			1915		
Crow-Elkhart	4			4			4,4	6	
Cunningham			8						
Daniels			8			8			
Davis		6,6			6,6		4	6	
Detroiter		6		4			4		
Dispatch	4			4					
Dixie	4								
Dodge	4			4			4		
Dorris		6			6,6		4		
Dort	4			4					
Drexel	4								
Drummond			8						
Elcar	4								
Elgin		6							
Emerson	4								
Empire	4	6		4	6		4		
Enger			12			12		6	
Fiat	4			4	6		4	6	
Ford	4			4			4		
Franklin		6			6			6	
F.R.P	4			4			4		
Geneva		6							
Glide		6			6		4		
Grant		6			6		4	6	
Hackett	4								
HAL			12			12			
Hatfield	4								
Harroun	4								
Harvard	4			4					
Haynes		6	12		6,6		4	6,6	
Hollier		6	8			8			
Homer-Laughlin			8						
Howard		6							
Hudson		6			6			6,6	
Hupmobile	4			4,4			4,4		
Inter-State	4			4			4		
Jackson			8	4		8,8	4	6	
Jeffery	4	6		4	6		4	6,6	
Jones		6							
Jordan		6							
Kent	4								
King			8			8,8	4		8
Kissel		6,6		4	6		4	6,6,6	
Kline		6			6			6,6	
Lambert	4	6							
Laurel	4								
Liberty		6							
Lexington		6,6		4	6,6			6,6	
Locomobile		6,6			6,6			6,6	
Luverne		6			6			6	
Madison		6			6				
Maibohm	4								
Majestic			8,8						
Marion-Handley		6,6			6				

Car	VARIETIES OF ENGINE MANUFACTURED								
	1917			1916			1915		
Marmon		6			6			6,6	
Maxwell	4			4			4		
McFarlan		6			6,6			6,6	
Mercer	4			4			4		
Metz	4			4			4		
Mitchell		6,6			6	8	4	6,6,6	
Monitor	4	6							
Moline-Knight	4,4			4			4,4		
Monroe	4,4								
Moon		6,6			6,6		4	6	
Morse	4			4			4		
Murray			8						
Napoleon	4								
National		6	12		6,6	12		6	
Oakland		6	8	4	6	8	4	6	
Ogren		6							
Oldsmobile			8	4		8	4	6	
Overland	4,4	6		4,4	6		4,4	6	
Owen Magnetic		6,6			6.6			6	
Packard			12			12		6,6	
Paige		6,6			6,6			6	
Partin-Palmer	4,4			4,4		8	4,4		
Paterson		6			6		4	6	
Pathfinder			12		6	12		6	
Peerless			8			8	4	6.6	
Phianna	4								
Pierce-Arrow		6,6,6			6,6,6			6,6,6	
Pilot		6			6,6,6	8		6,6	
Premier		6			6			6	
Princess	4								
Pullman	4			4	6		4	6	
Regal	4		8	4,4		8	4		
Reo	4	6		4	6		4	6	
Richmond		6							
Roamer		6							
Ross			8			8,8			
Saxon		6		4	6,6		4	6	
Scripps-Booth	4		8	4		8	4		
Simplex		6		4,4	6		4,4		
Singer		6			6			6	
Standard			8,8		6	8			
Stearns-Knight	4		8	4	6	8	4,4	6	
Stevens		6							
Studebaker	4	6		4	6		4	6	
Stutz	4			4,4			4,4,4	6,6	
Sun		6							
Templar	4								
Velie		6,6			6,6		4	6.6	
Westcott		6			6,6		4	6	
White	4			4,4			4,4		
Willys-Knight	4	6	8	4			4		
Winton		6,6			6,6			6	
Woods	4								
Yale			8						

SIDE GUIDE & GRIFFEN

No New Trends in Power Plant Design

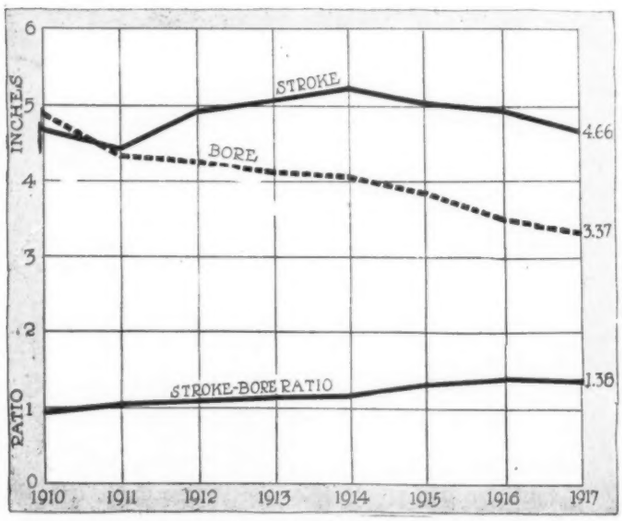
Percentage of Four and Six Cylinder Engines Little Changed—Not Many New V Engines—Unit Construction Advances Steadily—Overhead Valves Gaining—Splash Lubrication Falling Off Rapidly

IN concluding the review of power plant design, a year ago, we said that probably 1916 would bring forth few novelties, because 1915 had been so prolific in this respect. We said that 1916 would probably be a year of development of the ideas of 1915; a year of great production. It has indeed proved true. The most vital thing the motor car buyer has gained by virtue of the work done in 1916 is a better engine. A much better made engine which will run longer without trouble or attention. In 1915 design was at one gigantic stride, removed from the mediocre to the excellent. In 1916 manufacture has followed design, and it is developing so fast that he would be a bold man that would dare to forecast what may happen.

Slight Gain in V Engines

The two typical passenger car engines are still the four and the six. The conclusion reached a year ago, that fours, sixes, eights and twelves each had their spheres appears to be borne out by the percentages deduced from the listed models of all American 1917 automobiles. From a production viewpoint, of course, the four enormously outnumbers all other types put together.

There are more eights on the market and more twelves, but there has been no landslide toward the V engine. Rather one might say, the makers of good stock eights have obtained a few more customers. Last year it was remarked that we seemed no nearer to an ideal cylinder size, unless the popularity of 3 by 5-in. was any indication. This year dimensions not very far removed from 3 by 5-in. are extremely common, and the average piston displacement of 222 cu. in. is only a trifle greater than the P. D. of a 3 by 5-in. six which is 212 cu. in. Stroke to bore ratio for 1917 figures almost exactly the same as last year, being 1.4 to the nearest tenth.



Since 1914 the bore and stroke of the average American automobile engine, as shown by the list of American cars on the market has fallen, but the stroke to bore ratio increased up till last year, since when it has hardly altered. The average engine now has a piston displacement of 222 cubic inches, so the 3 by 5-inch six-cylinder is very close to the average as it figures 212 cubic inches

Gear ratio has been lowered still more, 4.15 as against 4.08, and this is added to in effect by the 2 in. reduction in the size of tires. Taking the piston displacement per mile traveled on high gear, however, this is almost exactly the same because of the reduction in engine dimensions. It is now 384 cu. ft. instead of 380. This, incidentally, is the smallest variation ever shown over a year. It is safe to argue from this that we have touched bottom on gear ratio, that four to one in round figures is suitable for the modern engines.

The decrease in average size of engine is no doubt due partly to the abandonment of some more big sixes. Just to mention one example which is typical; Buick this year gave up the large six and continued the small one which was new in July, 1915.

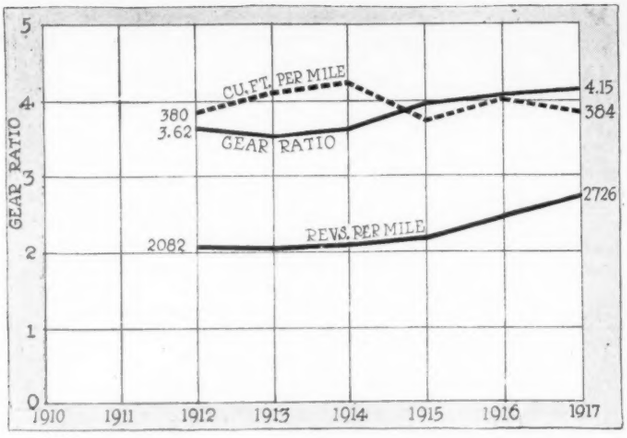
Some New High-Priced Fours

There is one feature of the new cars of 1917 which may mean much or little, and this is the coming upon the market of several fours of fairly high price and corresponding quality of workmanship. That the high grade four will be a popular car model next year is predicted by a good many engineers; whether they are right or not will be settled by the success or otherwise of these newcomers to the industry.

One of the most interesting features of the trends in engine design is the now easily perceived rise in favor of the overhead valve construction. A year ago there was a general feeling that the valve-in-head was on the increase, yet the averages showed an actual falling off in the number of models of this type.

The number of valve-in-head engines is now 20 per cent of the listed models, and it has never before in history touched this height. Meanwhile the T head has fallen off considerably, being at a lower mark than ever before. This is an interesting situation because we have two of the most prominent new cars of the year in the sixteen valve Stutz and White. If these prove striking successes it is highly probable that we shall see several more of the same sort. Really, though, the sixteen valve deserves a separate classification, and will probably have to be separated from the usual cylinder nomenclature. The popularity of the overhead valve is certainly largely owing to the return of the detachable cylinder head, which is used on almost every new engine and has replaced the one piece L head on several cars. Perhaps the most notable new user of the separate head is Packard, who went over to this form in July.

As the best example of specialization on this matter of cylinders, there are only nineteen manufacturers in the tables who make cars with more than one number of cylinders. Last year there were thirty-two appearing in this category. Specialization is particularly to be noticed with eight and twelve-cylinder cars, although there are several makers of sixes and eights or sixes and twelves. Among the six-cylinder specialists there is quite a tendency to concentrate chiefly upon one small six and to build a big six at a much higher price for large, heavy bodies. Apparently the purpose of this



Decrease in tire size on an average of the listed models of American cars, coupled with a slightly lower gear ratio in the rear axle has increased the revolutions per mile of the engine on high gear, but the drop in the average size of engine has more than offset this, so that the piston displacement per car mile has fallen a little

is to be able to give the dealer something for that occasional customer who "likes the little six very much but wants a rather larger car."

Power per Cubic Inch Is Higher

Power per cubic inch of piston displacement is a little higher now than last year perhaps, but the extra power obtained during 1915 has brought about other changes in the 1916 cars that are now showing up. Of these there is no doubt whatever that the great increase in the popularity of pressure lubrication is one.

Last year over 50 per cent of engines had plain splash oiling. To-day only 35 per cent are without pressure feed to at least the main crankshaft bearings, and 30 per cent have full pressure systems involving a drilled crankshaft. The increased crankshaft speeds have made it necessary for high efficiency engines to have their oil fed by something more positive than gravity.

Though it does not appear in the statistics, there has been some change in the straight splash systems, for the design of dip troughs and oil gutters has been improved, so that the average splash system is more effective than it used to be. It will be particularly interesting to see, a year from now, whether the pressure system has gained any more, or whether the balance has now been struck. The lubrication of American cars is now divided up in about the same proportion as was that of the European vehicles in 1914. Variable pressure, interconnected with the throttle in some way, is gaining favor, and by the end of 1917 it may have reached a position of sufficient importance to make it show in tabulation.

Lubrication Undergoing Changes

Probably there is no detail of engine construction that is more disturbed just now than this matter of oiling. The heavier gasolines with their tendency to throw down kerosene on the cold walls of the cylinders give trouble by destroying the lubricating power of the oil, and multicylinder engines have had some trouble through vapor passing the piston rings and depositing water in the crankcase. Thus longer pistons and pistons with better rings and ring arrangement are coming into use. Passing the oil through a cooler outside the crankcase has been begun and we may soon have filtering chambers and water extracting attachments on our cars. The control of oil temperature may come hand in hand with that of the cooling water, so that many new developments in lubrication are to be anticipated for 1917.

Speaking of lubrication, and the fact that changes have been made in order to overcome slight troubles, leads to a consideration of troubles in general. There have been a good many minor engine troubles with the 1916 cars, mainly owing to the much higher average speed given by the low ratios in the rear axle gears. They have rarely been serious troubles, but that sort of little thing which the manufacturer does not like to have in his car. Corollary to the lubrication difficulties we have had increasingly rapid carbonization, though this is much less serious a trouble now the detachable head has come back again. There have also been bearing troubles, and these have been cared for by an all around increase in crankshaft dimensions and by more careful bearing fitting.

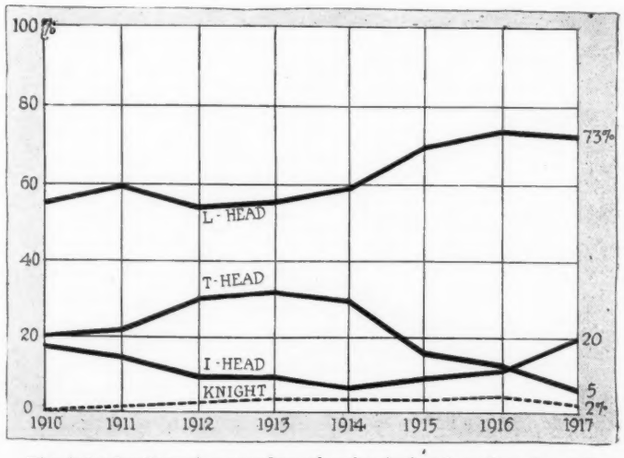
There are many ways of finishing bearings. One is to die-cast the bushings, ream them, after splitting them and putting in shims, and then adjusting them on the shims. Another is to size them after they are in place by pushing through a burnisher of sorts. Another is to abandon the use of shims and to scrape each bearing by hand to fit the particular crankshaft. All three methods, and others also, have their advocates, and they all seem to give good results if they are carried out with sufficient care. Manufacturers are spending more time on bearings now, and are keeping cars out of the service stations. It is hardly too much to say that the high engine speeds of modern times have shot to pieces many of the accepted ways of fitting bearings and, especially, of cutting the oil grooves in them. It is more a matter for the factory than for the drafting room, and the factories are rapidly finding out how to make better bearings without increasing the cost.

Better and as Cheap Manufacturing

That is one of the most wonderful things about the manufacturing side of the industry. Once show it that an old method is not good enough and it soon discovers that a better method is no more costly and may even be cheaper. As a result, engineers are calling for many things now that they dared not demand a short time ago and the ultimate owner is reaping the benefit.

Materials of construction have been troublesome in 1916. Steel has been obtainable, but with delay, this making things hard for the drop forge firms. Aluminum has been expensive and there has been a little trouble with it, owing to the lack of crucibles, which have been very difficult to obtain. Unsuitable crucibles have an unpleasing habit of leaving minute particles of glass-hard carbon in soft metals which produce great trouble in machining. Luckily this is another of the troubles that have been fairly well overcome.

Iron castings are as good as or better than ever, and



The introduction of a number of valve-in-head engines has altered the inclination of the lines in this chart of cylinder forms deducted from the listed models of the past seven years. For the first time there are more overhead valve designs than T head and the latter construction has fallen away very rapidly

some splendid work in the foundries is now being done with cylinders and crankcase in one piece. The use of the detachable head helps enormously in this. Aluminum cylinders have been held back by the cost of the metal, but those which are being used have proved themselves and there is no question now as to their merit; there will be plenty more as soon as aluminum is cheap once again. Incidentally, the prediction is that aluminum will be cheaper after the war than it has ever been in history, because of the increased facilities for production.

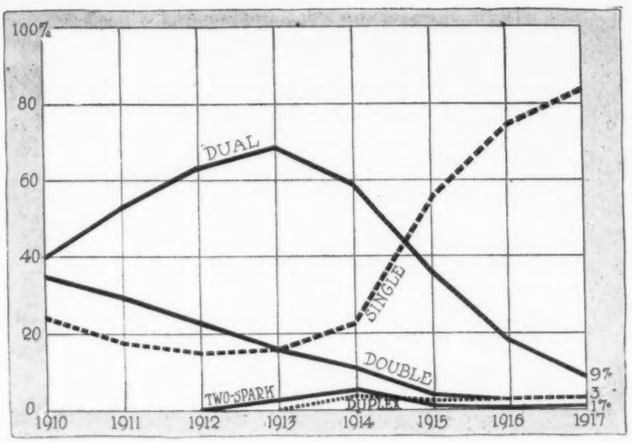
Changes in Piston Alloys

There have been some changes made in aluminum pistons, mainly with respect to the exact alloy used, experience showing that some alloys are better than others. We have alloys now with a much lower coefficient of expansion and a much harder surface, and these are more suitable for pistons. Allowing the piston pin to rock directly in the aluminum piston seems to have been quite successful and is regular practice to-day. For cylinder wall wiping the most favored piston construction is that where there is a V groove just beneath the bottom ring of the three, this groove having small holes drilled through to the inside of the piston. The scraper ring at the foot of the piston skirt has not gained, nor have any of the "freak" piston designs come into extended use.

Connecting-rods are being made more carefully, so as to save weight, and are being weighed and balanced in process of manufacture, even for some quite cheap cars. This, of course, is for eliminating vibration, and some of the quite large producers are even now considering ways and means for machining their connecting-rods all over like those of a racing car.

Valves are not much changed. The shortage of tungsten, chronicled last year, is still very serious, and some valve metals have been developed which contain none of the precious metal, but have many of the properties of tungsten steel. It is quite usual to employ tungsten valves for the exhaust and a nickel steel for the intakes, a point that should be remembered by the motorist when grinding valves, so that the same valves go back on the same seats.

Returning to some points of design, it is noteworthy that there has been no change whatever in the proportionate use of pump and thermo-syphon for water circulation. These are still sixty-two pump to thirty-eight syphon, which is rather remarkable, as it follows a noticeable increase in syphon cooling a year ago. In fuel feed, which is best considered in connection with engines, the Stewart vacuum tank has continued its meteoric rise into favor, and is now used



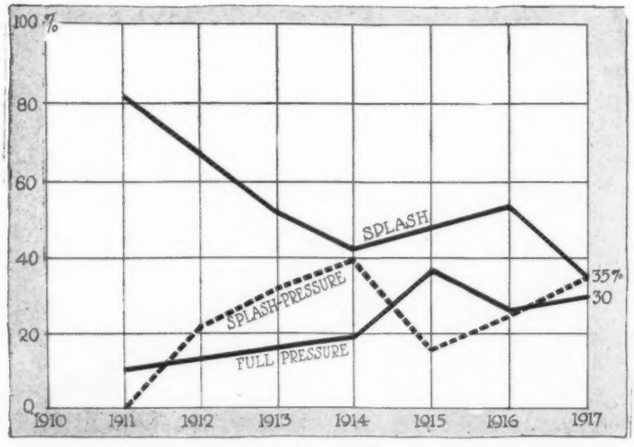
There are only a few cars left on the market which have anything but single spark ignition. Probably the fact that dual and double ignition, which together were almost universal a short time ago, is a testimonial to the great improvements that have taken place in single ignition systems; while the coming of the electric starter, eliminating the labor of hand cranking, has had a large influence

on 74 per cent of the listed models. Gravity feed is now found on only 18 per cent, and pressure accounts for the balance. There have been instances where a rather larger vacuum tank has been adopted, but no single instance of a vacuum feed having been abandoned after it had been taken up. This Stewart tank ranks with the Bendix starting motor pinion, as one of the most remarkable successes in the history of the industry.

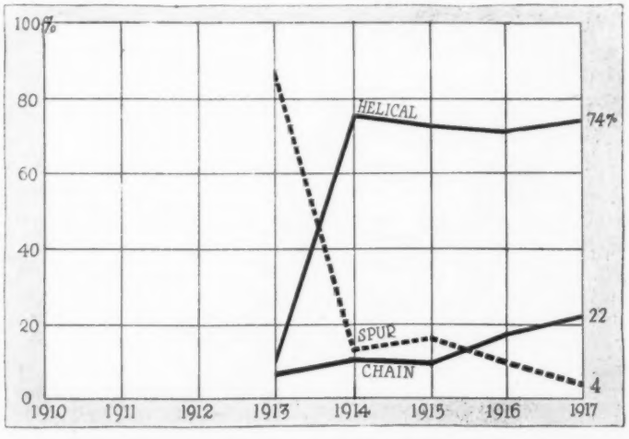
Unit Power Plant on 77 per Cent of American Cars

The unit powerplant now stands at 77 per cent af all types, just the same as the proportionate preponderance of the amidships location in 1910. More firms have dropped the rear axle gearset and six have abandoned the amidships, which has now only 14 per cent of supporters. Here it may be mentioned that, from the quantity viewpoint, the outputs of Overland and Studebaker, who still adhere to the rear axle gearset, are very large; but it is a long time since a new car or a new model altogether has appeared with anything but a unit power plant.

Single ignition also has followed the trend shown for four years past, rising in that time from under 20 per cent up to 84 per cent in that time. Of all the other forms of ignition dual has dropped to 9 per cent and double, duplex and two-spark together make up the balance of 7 per cent.



A big falling off in plain splash lubrication and a gain in full pressure, which dropped off last year, is the chief characteristic of the trends in lubrication shown by the American cars of 1917. The increase in combined splash and pressure systems since 1915 is a feature of this chart



The form of gearing used for driving the camshaft and any other shafts at the front end of the engine has undergone a great change since 1913. Chain front ends are making steady progress, though there has never been any boom in this form; the helical gear is now almost as quiet

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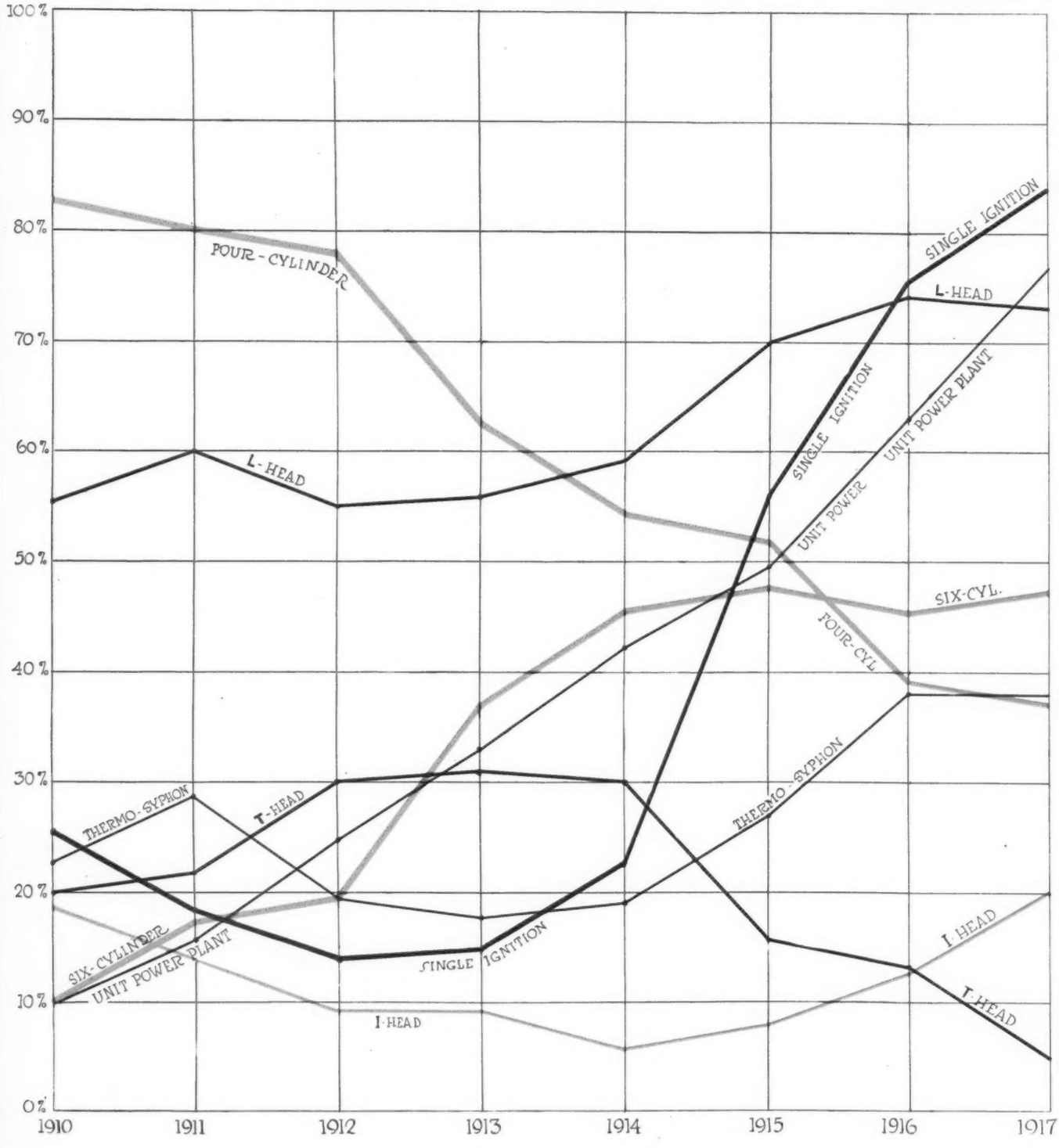
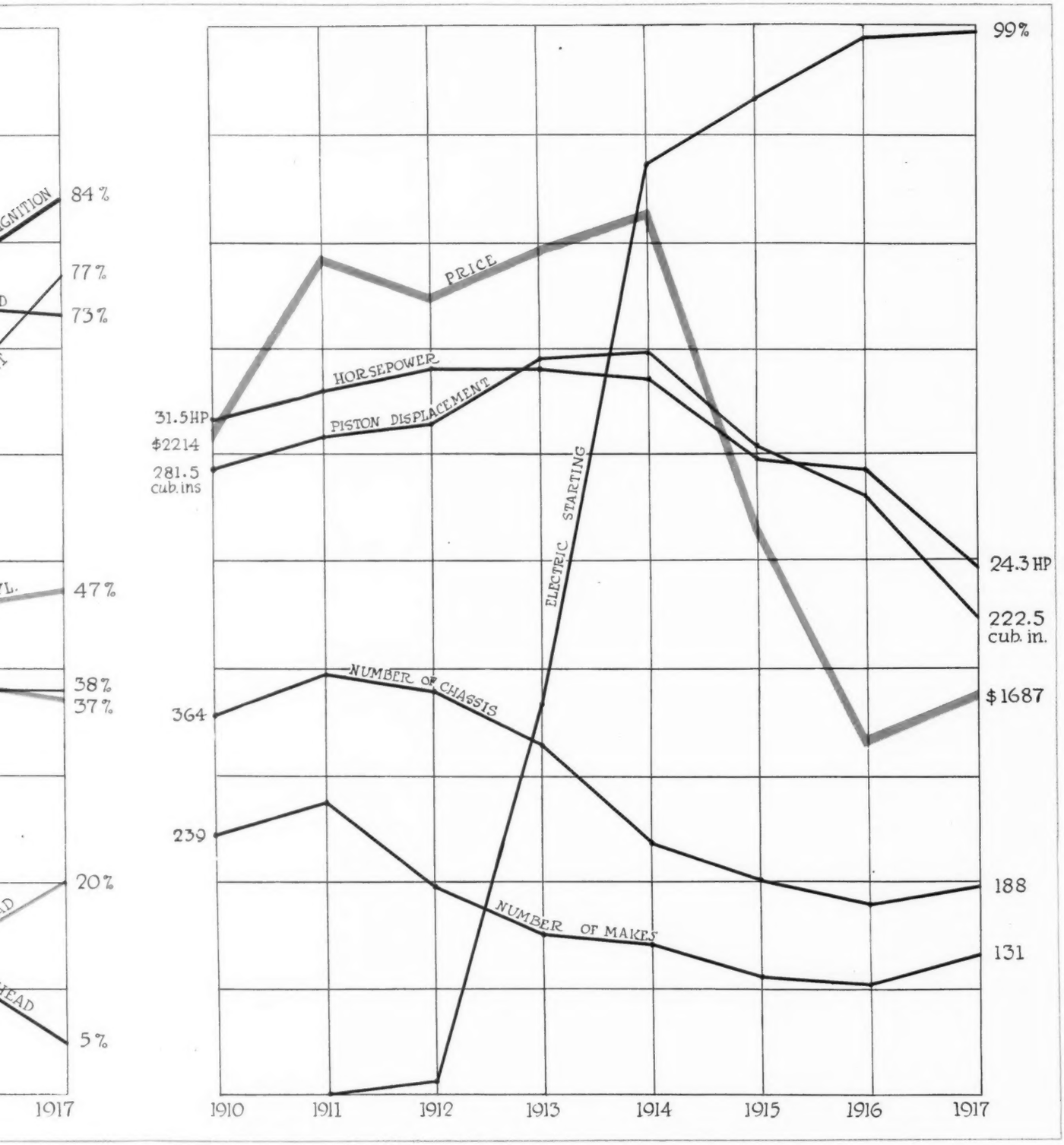
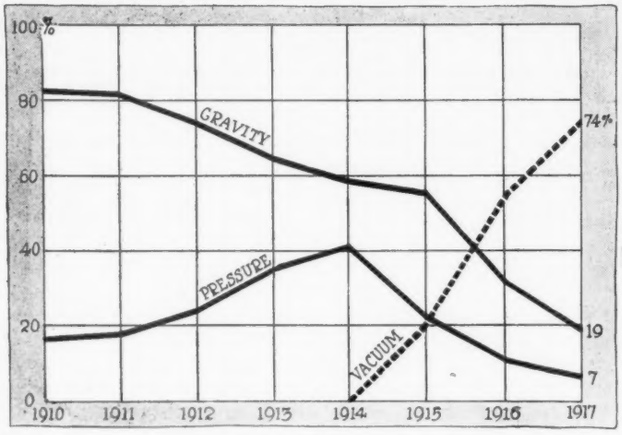
Trends of the American Automobile for
Important Factors in Desig



e for 7 Years, Showing Variations of Most Design and Manufacture





Nothing has been more impressive than the rise of the Stewart vacuum fuel feed. In 1914 it was obvious that the gravity system would soon be used only on the less expensive cars and that air pressure in some form would be the conventional type of feed. The invention of the Stewart tank completely changed the whole situation

In camshaft driving the chain has made a further gain, continuing the rise noted last year and passing the 20 mark, being now used for 22 per cent of the models tabulated. Helical gear is used for 74 per cent, about the same as last year, and spur gear has dropped to 4 per cent. In connection with camshaft and front end drives generally, several improved silent materials are now being used extensively. Some of these non-resonant substances are almost as strong and durable as steel and they are easy to machine and are unaffected by oil. Fiber gears were always troublesome in the shops and liable to swell when oil soaked; old-fashioned fiber, that is. The newer materials are quite different, partaking more of the nature of Bakelite, and they are giving such good results that the growth in the use of chain front ends is the more surprising.

Intake Manifolds Are Vanishing

The intake manifold seems to be vanishing. Nearly all the new engines have integral manifolds for the intake, and their use is encouraged greatly by heavy gasoline. In some engines, notably the Brush eights and fours, this internal manifold is not completely cooled by water, having one spot at least where the exhaust gas in an adjacent exhaust valve pocket, can play directly on the wall of the manifold. This "hot spot" construction is said to be of great assistance in helping a cold engine to very quickly reach a point where it will fire regularly. Modern gasoline has called for a complete re-analysis of manifold design and we shall certainly see still more of this done during 1917.

Somewhat curiously there has been no development in exhaust manifold construction. There are some excellent manifolds, like the Moore used on Lexington cars, which do help to reduce back pressure, yet engineers never seem to have given the subject any real attention. No doubt this is waiting for some future year when more pressing matters are disposed of.

Power per Unit Volume Increased

The power per cubic inch that an engine can produce depends upon its "breathing" capacity, and the power per unit of weight is also wrapped up with this same matter. Breathing is affected by the resistance offered to the entrance and exit of the gases, and it is this that has led to the production of engines with four valves per cylinder. So far so good, but the valves alone will not be working at their best unless the manifolding is equally efficient. Intake manifolding, especially for six-cylinder engines, is difficult and it is usual on aviation engines, to find two carbureters for each set of six cylinders in an engine. Exhaust manifolding for high efficiency motors of the racing type has not been studied very much. Even for army aircraft there is not yet, so far as is known, any efficient method of muffling without loss of power. If the high efficiency engine is going to become common for automobiles, we shall have to give very careful consideration to exhaust manifolding and to muffler design, the latter being a subject about which not 1 per cent of our engineers know anything worth mentioning.

Engine Suspension May Change

Although three point suspension is the most favored, it is possible that the coming of the ultra-rigid frame may cause a change to take place. The idea of three point suspension is to prevent weaving stresses in the frame from being transmitted to the crankcase. In the past two years, however, especially the year 1916, crankcases have been made much more rigid, in order to minimize vibration. When the frame is much stronger and so less likely to weave, and when the crankcase is much stronger and so able to offer substantial resistance to any stresses imposed, there is some reason for thinking that the frame and crankcase may well be made to stiffen each other. In other words the crankcase, if it is strong enough and if the frame sides are deep enough, may be used as a cross member of the frame without much fear. Making the front end of the frame quite inflexible, by bolting the crankcase on with four or more points of attachment, helps to keep down hood rattles and even fender squeaks; it keeps strain from the radiator also. Three point suspension has been something of a fetish, it will be interesting to see what position it occupies a year hence.

Better Balance Characterizes Engines of 1917

Both the requirements for pressure lubrication, and the desire to remove vibration have led to a general reconsideration of crankshaft design. There are two systems of crank construction in use. One is the massive crank, intended to be of such strength and rigidity that it cannot be deformed by any forces within the engine. The other, and this is the more scientific form, has peculiarly shaped webs or has balance masses attached, so that the disturbing forces are neutralized wholly or in part.

It has been shown recently that a two-bearing crank can be used in a four-cylinder engine or even in a small eight without trouble, if it is balanced efficiently. It has also been shown that a combination of balance masses with a large diameter can remove both bending couples and torsional strains from a six throw shaft. Really what is not known now, and is being most sought after, is how far it will pay to go in special crank construction.

If we are going to have complicated balance masses, it may be that we shall go back to the built-up crank, as offering something simpler to make than a forged crank with balance pieces integral or bolted on. It may be that the balancing will all be done by the form of the webs in a drop forged crank, or it may be that something quite new will be discovered. Crankshaft design to-day is in a plastic state and it is probable that several years more must elapse before the final analysis can be made.

The accessories around an engine are generally much better arranged. The generator is now usually so mounted that its oilers and brush gear are within reach, the ignition unit is so placed that it can be inspected, cleaned or adjusted without mechanical acrobatics. The high placing of carbureters, due to the vacuum fuel feed, has rendered this important detail easy to clean and adjust, and there have been many instances where oil filling caps have been moved so that it is now possible to pour in lubricant without the assistance of a special funnel. Fan belt adjustments are easier too, and the gland of the water pump is usually located where a simple form of spanner will reach it.

Transmission Follows 1916 Trends

Increased Facilities for Manufacture Raise Spiral Bevel to 70 Per Cent— Strong Interest in Electric Transmissions Has Not Led to Much Increased Usage—Electric and Other Drives Features for 1918

THAT in 1918 or 1919 electric, hydraulic or some other new form of transmission will be in wide use seems possible. Whether this last word ought not to be "probable" is debatable. At present there is only the Owen Magnetic and the Woods Dual-Power to act as representatives of the gearless transmission, but inventors are busy and hardly an experimental room of any important factory but has its model job on trial. We have reached the limit of flexibility with the gasoline engines we have to-day, and to get any better sort of performance it will be necessary radically to alter the transmission. The conventional chassis has been developed to the limit as far as flexibility and controlability are concerned; anything better to come must be a break away from the conventional.

It is noteworthy that in S. A. E. meetings and the haphazard conversations of engineers, the elimination of the gearset is a favorite topic, and has become so within about the last six months. Thus while it is not possible to chronicle any important changes in transmission systems to be deduced from the averages of the 1917 cars, it is fairly safe to predict that next year or the year after will show an upheaval in the detail of the transmission of power from the engine to the road wheels.

Owen Magnetic Starts Movement

It may be, of course, that this is but a phase, that we shall find gear transmission is, after all, better than anything else, but if this is not so the credit for opening the eyes of the engineering world must go to the Owen Magnetic and the men who were behind it. In the history of automobilism there have been many attempts to market an electric transmission car; the Owen is the first instance of a successful attempt.

The magnetic gearshift appears on one more car this year, this being the new Premier, and of pure electric transmissions there are only the two already mentioned. Nearly every American car is gear driven still. There have been few changes in either gearing or clutch construction, except that clutches are easier to release and gearshifts easier to operate. Three speeds are used for 85 per cent of the listed models of chassis, four appearing on only 12 per cent; the remaining 3 per cent being composed of electric and friction drives.

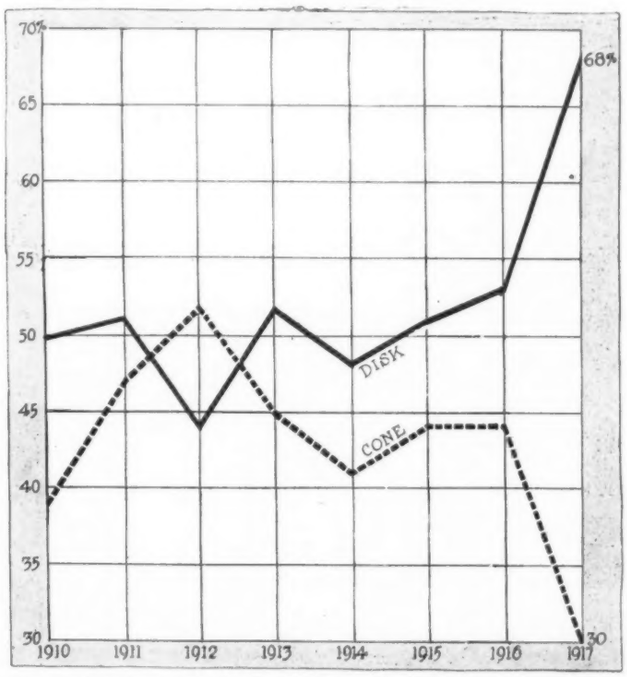
Disk Clutch Makes Big Gain

In 1915 a good deal of redesign took place in clutches, and there was a strong trend shown toward the dry disk type. A year ago 53 per cent had disk clutches and 43 per cent cones, the disk having gained substantially during the previous year. Now, in January, 1917, the disk has grown to 68 per cent and the cone shrunk to 30 per cent, this being the widest distance they have been apart since these statistics were first recorded in January, 1910. Since then the disk has led the cone and the cone the disk alternately, the average up to last January being almost a straight line, but now the disk seems to be asserting itself strongly.

It is worth noting that the cone clutch is still used by a number of the largest producers, that is to say, manufacturers who have an entirely successful type of cone clutch seem loth to change it. Nearly all new cars, however, have a disk clutch, and this is nearly always of the dry type. A particular make of clutch deserves mention in this connection, this being the Borg & Beck. It is a single plate dry clutch, and has multiplying levers within it, so that the same external pedal leverage can be used and still a very much lighter action obtained. This clutch is conspicuous in the specifications of many new cars.

The multiple disk clutches made by practically all the well-known producers of gearsets have been improved by making them disengage with a slightly shorter travel, and there is a tendency to increase the number of disks, thereby giving longer life and reducing the spring pressure required. Asbestos and some other substance in combination is still the preferred facing material, but experiments are being made with cork compounds, and these seem to perform well. Increase in engine speed by means of lower gear ratio has made it a little easier to get smooth clutch action, and engineers have given this matter considerable attention this past year.

In the gears themselves, in the steels of which they are made and in the shafts upon which they are supported there has been no change. The makers have been far too busy this past year to change designs, and the gearsets of 1915 were far too good to tempt alteration. A movement for combining the speedometer drive with the gearset has started, but it has not gone very far as yet, and there is no evidence of a



Ever since these annual analyses of engineering tendencies made from the listed models of American cars were first prepared there has been a fairly even division of the field between the disk and the cone clutch. This year, for the first time, the disk clutch is to be found on more than double as many cars as the cone clutch. In the past two years there have been few new cars put out with anything except dry disk clutches

much increased tendency to mount the tire pump on the side of the gear box, although this is a good place for it and is favored by several firms.

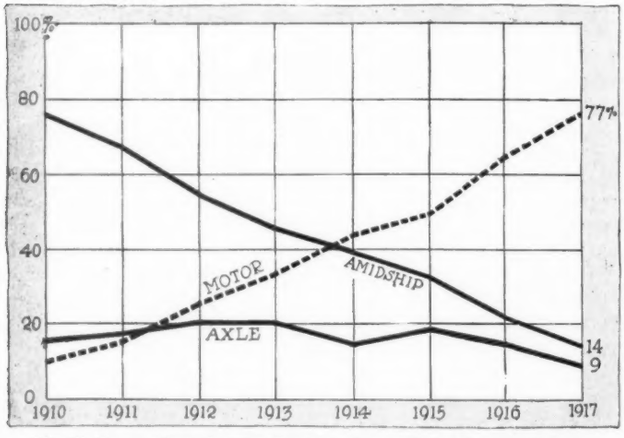
Semi-Floating Axle Gains Supporters

In rear axle construction the semi-floating type has followed the rising tendency shown last year and is now used on 25 per cent of listed models as against 23 per cent. Full floating has dropped from 52 to 43 per cent and three-quarter risen from 23 to 29 per cent. Thus there has not been much change on the whole. Of course, spiral bevel drive has increased. A year ago there would have been many more cars with this form of bevel gearing if it had been easier to buy or make the gears, but the Gleason company having practically a monopoly of the manufacture of spiral gear cutting machines, it was only possible to make a certain quantity of gears. During 1916 most factories have been supplied with their spiral bevel cutting equipment, so that 70 per cent of the cars on the American market now have this form of final drive. Plain, or straight bevel, is used by 28 per cent, and the remaining 2 per cent is divided between worm drive and chain drive. Had it not been for the spiral bevel there is little doubt but that the worm would have been used a great deal by this time, but this new form of bevel seems to do all that is wanted at a lower cost, and with at least as high an efficiency as the worm. Worm gearing is practically dead just now as far as passenger cars are concerned.

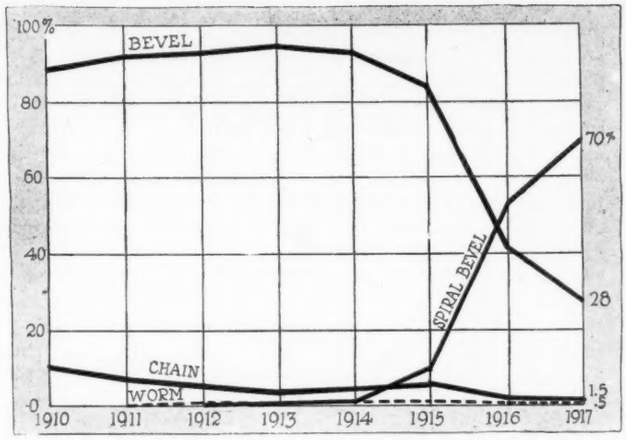
Brakes Being Improved Considerably

Brakes, as already mentioned, have had a general overhauling. THE AUTOMOBILE'S often repeated contention that the brakes are just about the worst part of the average car, is an opinion that is obviously shared by a good many engineers, and the detail design of brakes is beginning to obtain attention. The things that have been done are not the sort that show on the outside, or in the specification. They concern the accuracy of manufacture of pins and connections; the size of the levers and pull rods (to eliminate spring); the dimensions of the spreading cams or linkages and the ease of operating the adjustments. Nearly all cars have an external foot brake and an internal hand brake on the same rear wheel drums, but much more care is being taken in making the connection between the axles and the pedal or hand lever. Lost motion is being sought out and done away with, and the effect of spring action on the brake linkage has been studied closely almost for the first time.

Hotchkiss drive, or a hook up where the springs take both the driving thrust and the torque of the rear axle, is now used on 44 per cent of the cars listed, and Hotchkiss drive demands a careful brake layout. Movements of the axle due to spring action are reflected in movements of the brake links, and it is necessary to choose centers for the levers in the brakework, so that the effect of spring action upon the brake pedal and lever shall be a minimum. The art of laying out brakes properly is only just beginning to be studied, even by the very best makers (with a few exceptions) and still more improvement during this year is to be expected.



Of all the engineering tendencies observed in the yearly compilation of specifications of American cars none have shown steadier graphs than these. The use of the rear axle location for the gearset showed little variation till two years ago, and since then the fall has been slight, but the rise of the unit power plant and fall of the amidships gearbox mounting have been correspondingly rapid



It was in 1914 that a new and easy way to make spiral bevel gearing was discovered, and the extension of the use of this form has gone hand in hand with the production of the new gear cutting machines. The spiral bevel killed any chances that the worm drive might have had in the passenger car world, and it is replacing the straight bevel as rapidly as could be

In springing the most striking change is the rise of the semi-elliptic type. Last year this was found on only 15 per cent of the cars, but it is now the stock model for 36 per cent. Cantilever springs have stood still at between 27 and 28 per cent, and the three-quarter has dropped from 42 per cent to 27 per cent, being now just level with the cantilever. Thus the great spring movement of the year is toward semi-elliptic.

Spring Design Much Studied

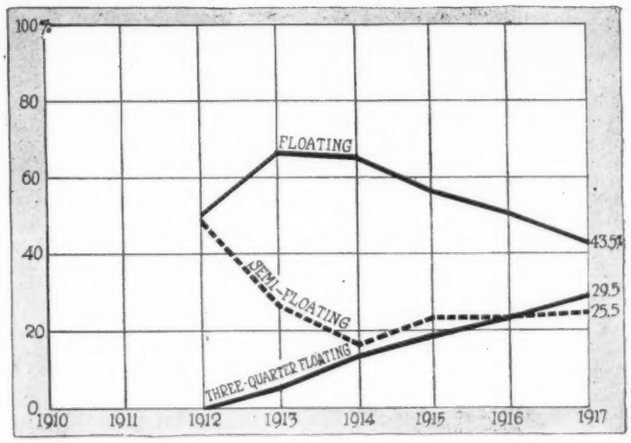
This is a particularly interesting fact, because it was just 2 years ago that the cantilever burst upon the American industry as a new type. It seemed possible at that time that the cantilever would become the leading design, so great was the interest that it created. But time has proved that the simplest sort of spring, the semi-elliptic, is capable of giving almost precisely the same action as any other kind of spring. Being the simplest, the easiest to apply and the easiest to use with Hotchkiss drive, the semi-elliptic has gained enormously.

Platform springs and elliptic springs are retained by a few of their old supporters. Cadillac and Packard still cling to the platform; Franklin and Jackson to the elliptic. These forms of spring can give excellent results indeed, but they are a good deal more difficult to design than simpler forms. When they are developed to a high degree of excellence there is no object in changing them, but for an entirely new car the simplicity of the half elliptic appeals.

To mention a matter that is little considered and does not appear in any tabulations, the details of spring fitting have proved to be very important. It has been discovered that spring rattle is almost always due to looseness *sideways* between the ends of the springs and their shackles or securing housings. Thus the 1917 cars are much better made in this respect. The S. A. E. is even now engaged on determining the proper tolerances for sideways fits of spring eyes.

During the year a great many experiments have also been made with spring bolt bushing materials. Various new schemes for lubrication have been tried, and not a few self-lubricating bushings containing graphite. The latter have been a disappointment on the whole. Bronze bushings with

graphite insertions seem usually not to show up very well because the movement is so slight that the graphite is not properly spread over the bolt. Soft bushings of wood impregnated with graphite, or of some other material that is susceptible to impregnation, are usually too soft to stand up under the pressure to which they are subjected. Thus spring eye and shackle design is in a plastic state. It seems likely just now that the diameter of the bolts may be increased, so as to give greater area and permit the use of a soft material for the bushing. It is suggested in some quarters that a rocking or sliping joint may replace the bolt. Whatever may happen in the future, there is no doubt that few manufacturers are wholly satisfied with the present state of affairs, so novelties in this line may be looked for in the coming year. The point is a small one, but it is important to the owner who looks after his own car. This individual, by the way, is getting 100 per cent more attention this year than he had in any previous one.



Calculating averages from the specifications of the 1917 American cars, shows that the full floating axle is still the most popular type. Both semi-floating and three-quarter are gaining, however, being now not far from equal. Since this subject of axle type has been a prolific producer of argument these graphs are a particularly interesting study

Multiple Leaf Springs Coming

There are a good many new theories abroad regarding springs, but spring design has suffered from too much theory rather than from too little. The experienced engineer accepts a spring theory when it works out and not before. One new idea is that the softness of a spring depends upon the number of leaves, and this proves out well. Some of the springs now in use have thirty leaves, and some have been made with many more. These springs have the most beautiful action, but they are not being used much yet, owing to the difficulty of getting steel in the requisite section. They are expensive, of course, for the cost of a spring is bound up with the number of handlings each leaf has to have. Another thing that is all in the air is how a spring should be divided by the axle. There seems good reason to believe that the best action results from setting the axles forward of the middle of the spring, and some of the latest cars have the axles mounted in this way. Spring design is going to be one of the things to look for at the 1917 shows and one of the things to watch when the 1918 model cars make their appearance.

Improved Electrical Detail

Few Changes in Electrical Equipment Except in Small Detail Are To Be Noticed

MECHANICALLY the starting motors used on the automobiles of 1917 are identical with those of 1916. The Bendix pinion has conquered a few more of the small number of manufacturers that were not using it a year ago, and some of the motors have been improved electrically, so that their size and weight could be cut a trifle. Otherwise it is safe to say that the starting motor was so near perfection in January, 1916, that no alterations have been either necessary or desirable.

Generators are smaller and lighter and they are a little simpler, too. Instead of many different systems for controlling their output, we now have only three in common use; the third brush system, the voltage vibrator regulator and the current vibrator regulator. Reversed series regulation has also some staunch supporters, but this is closely similar in electrical effect to the third brush system.*

Lower rear axle gear ratios, meaning higher crankshaft speeds have given higher generator speeds, and this has helped the reduction in size. Also the mechanical design of generators has improved, so that they are more efficient electrically. It is improbable, however, that next year's models will be smaller still, since it is hard to believe that the limit has not been reached, unless we take to driving generators much faster.

The combined generator and battery ignition unit is now almost conventional practice, and it has much to recommend it, being neater, simpler and lighter as a rule. Also the generator unit that is mounted on a flange on one end, bolted to a facing on the crank case is coming rapidly into vogue, displacing platform mountings formerly used on many cars. It is this type of mounting that the S. A. E. is trying to standardize at present.

There is now only one car made without electrical starting and lighting as stock equipment.

Of all the models of cars listed by American manufacturers for 1917, 87.5 per cent have three cell storage batteries, giving seven volts. This is a change brought about by the greater number of two-unit starting and lighting systems, since the six-cell, or 14-volt systems are used almost always with a single unit motor-generator. For flywheel motor-generators 24 volts are employed in a very few cases.

With the modern generator the voltage is held very steadily to seven, and this is just sufficiently more than the voltage of the battery to insure steady charging. Thus, when the engine is running, the potential prevailing in the system is a steady 7 volts and the lamp bulbs are made to suit this pressure. The S. A. E. has changed its standard nomenclature for bulbs calling them 7-volt bulbs instead of 6-8 volt bulbs. This is because there is actually no such thing as a two-voltage bulb. One suited for 7 volts will give a longer life and less light if put in a 6-volt circuit, and a shorter life with more light in an 8-volt one. The manufacturer knows that the lamp will be operated at 7 volts and makes his bulbs according to the effect he desires to obtain.

The S. A. E. standards committee has spent much time in 1916 on the consideration of lamp detail with a view to eliminating the focusing device, by so specifying all bulbs and all reflectors so that they will interchange. This work is as yet only begun, but enough has been accomplished already to be of great benefit to motorists who will soon be able to get a properly focused light and good illumination with very little trouble.

*For description of these regulating systems see THE AUTOMOBILE for Nov. 30, 1916.

Changes in Tires, Rims and Accessories

Invention in the Rim Industry Has Been Busy in 1916 —Many New Wheel Constructions Patented—Wire Wheel Output Increasing—Tires More Durable

ALTHOUGH the average car has wood wheels, and although there are new rims being used on the 1917 models, an annual review of this nature would be incomplete without reference being made to the unsettled state of the wheel-producing side of the industry.

A study of the pages of THE AUTOMOBILE for the past year shows two things very prominently, one that there have been a great many new steel wheels invented, and the other that a great many manufacturers who do not fit wire wheels as standard still like to have their cars photographed with this equipment. Facilities for the production of as many wire wheels as the industry would like to buy have been lacking. The demand has risen much faster than the supply could be advanced, for a wire wheel making business is not a thing that can be built up in a day. Even to expand the existing plants and to get the requisite machinery and supplies of material is an essentially slow process. Thus, while they may not be stock equipment, the number of buyers who take advantage of optional wire wheels is growing quickly, and the wire wheel is seen everywhere on the streets and in the open roads.

It is hard to tell what may be the outcome of the steel wheel made from pressings or stampings. This is a type that has reached an enormous popularity in Europe, where the wood wheel has been almost discarded, but this was due to lack of good wood. The best sort of wheel wood is said to be getting scarce in America, while the newer pressed steel wheels are some of them as light as or lighter than wood, and as cheap to make. It is not improbable that the disk wheel will soon cease to look strange and that we shall see cars coming upon the market with many different kinds of wheel.

Rims Will Be Stronger

While all demountable rims have been strong enough for fair usage, there is a growing opinion that stronger sections are desirable. This is probably because of the greater punishment given wheels by the much higher speed at which rough roads can be driven over with modern springing. Axles and wheels are not benefited much by the best of springs.

If the steel wheel gains during the year we shall probably see a gain in the detachable wheel also, because a detachable wheel is a great advantage. Not an advantage *over* the demountable rim so much as an advantage *in addition* thereto. The ideal equipment is undoubtedly detachability at both rim and hub, so that either the rim or the wheel may be changed at choice. For obtaining access to brakes the detachable wheel is so useful that this advantage alone is enough to encourage adoption of the type. Like the wire wheel, most of the steel wheels lend themselves to the detachable principle and some of them can be made demountable as cheaply as they can be made in any other way.

Much Better Tires

The astounding performances of some of the tires used in the big races of the year, and the immensely greater mileage obtained by practically all the racing cars on tires of a variety of makes means only one thing, and this is that tires of 1917 are better than any tires ever made before. The rubber industry has been greatly disturbed by the scarcity of certain chemicals which used to come from Europe, and has had to find substitutes. In the course of this work it has hit upon new mixtures and new detail processes, with the result that improved rubbers have been found.

More Straight Side Tires

The recently created tire and rim standards division of the S. A. E. has recommended that the straight side tire be made standard for nearly all sizes of pneumatic equipment for passenger cars. This is because it is believed to be a better form for strength and durability. In making the straight side tire, it is claimed that the fabric is less stressed and distorted, and that the walls of the tire are shaped better for the purpose of withstanding continual deflection. One thing is absolutely certain, and this is that the number of pneumatic tire sizes and oversizes will be reduced still more. This will be an advantage to the user, for it cannot fail to make tires a little cheaper than they would be otherwise and it will reduce the stocks to be kept in tire supply stations, thus cutting down the time a tire is liable to lie in storage and insuring that the user gets a tire that has not been deteriorated by long resting in stock.

Better-Made Accessories

A rather more generous accessory equipment than last year's is to be noticed in going through specifications. Tire pumps are getting to be regarded as necessary, and are being fitted in neater ways, speedometer drives are mounted better and there are, among the different designs, some that are really sound engineering jobs. No doubt an inclosed drive from some part of the gearset will become conventional within a year or two.

The arrangement of accessories is better, we have now neater cowl boards with instruments that are more easily read. Simultaneously the assembly problem has been studied so that the many little parts that go on the cowl board can be put together in a unit or in two units and attached to the body in complete form. This avoids many an awkward job like attaching wires to terminals hidden away at the back of the board, and in this way a chance for mistakes is removed. With unit wiring assemblies and unit instrument assemblies the opportunities for some little neglect that will give trouble afterward is removed, or at least is very much reduced.

It is also noteworthy that the electrical accessories are much less scattered about the car than they used to be. The general adoption of the grounded return system of wiring has been followed by the elimination of many connection boxes, etc., the tendency now is to have a junction box, fuse clips, switches and ammeter all in one cowlboard assembly, thus centralizing nearly every terminal. Battery accessibility is improved, also making it easier for the driver to give the proper attention. During the year there have been patented at least two devices for indicating on the cowlboard the state of the battery electrolyte. No manufacturer has yet announced the adoption of any such device, but it must be only a matter of time before it becomes conventional equipment.

Body Proportions Changed

Roomy Driver's Compartment Follows Large Tonneau—Ease of Getting in and Out Studied—Four Passenger Roadsters Made More Comfortable—Growth in Use of Demountable Winter Tops

NOT long ago it was hard for even a man of average dimensions to find a car which he could drive with the same comfort enjoyed by his passengers. In many cases the position of the toe boards, the pedals, the steering wheel and the levers relative to the driver's seat was hardly thought of at all and, when a really good arrangement did occur, it was often a matter of pure, if happy accident.

This state of things no longer exists; although the perfectly proportioned car is not yet very common, the average is vastly better than it used to be, even a year ago.

Few External Changes

Externally the body of the 1917 car is similar to that of its immediate predecessor. The rounded, streamline form remains the most popular, although there are signs that we may have a new style presently. In a general way the style of body used by Mercer for the past couple of seasons seems to have served for a model in getting out the 1917 designs, as there is a distinct tendency to make the sides of the body curve outward rapidly from where they leave the sills, and reach a maximum width a trifle below the top edges, which latter are curved in a little. This gives a touch of solidity lacking in the body with perfectly flat sides.

On the other hand, among the custom built bodies appearing in the big cities there have lately been many where quite sharp lines are introduced. The boat type of body with a sharp upper edge, flared outward, and a minute strip of "deck" all around, is pure freak, of course, but the hard outline it obtains has been worked into these custom jobs. It is usual to find the solid sort of custom built bodies, not the bizarre types, afterward serve as models for stock cars, and this may prove to be the case in this instance. It is an undoubted fact that it is now hardly possible to design a conventional streamline body that is *truly distinctive*, and distinctiveness is half the charm of a good body style.

In a few instances there may be observed a tendency to depart from the usual vertical seat backs, and to slope the cushions in the European manner. When this is done the back of the seat is generally dropped a few inches, the effect on the sitting position being much the same as is obtained by cutting an inch or two off the hind legs of a chair. It is too early yet to say whether this tendency is going to become a real factor in body design, but it is a thing that is worth noting at the show.

Softer Upholstery

Nearly all manufacturers who can afford it are using deeper and softer upholstery this year, many more would have done so had it not been for the excessive cost of materials entering into this part of a body. This high cost may not be permanent, but if it is we shall see changes in the materials employed. The year 1916 has seen the introduction of a new upholstery in the form of the Marshall spring. This replaces a large amount of the curled hair, or hair substitute, and gives a softer cushion at the same time. The Marshall system is to have an enormous number of small coil springs each sewn up in a canvas case. These little springs are stacked together in the shape of the cushion, and just a little hair is laid on top of the assembly before putting on the leather. Thus almost each square inch of leather is supported individually, making the elasticity of the cushion the same at every point. The object of inclosing the springs is to prevent the coils of one from becoming entangled with those of its neighbors. So far this spring has been applied principally to expensive cars, Packard and Jordan being the first two manufacturers to announce its use.

Of materials for covering the cushion, etc., leather is still the most favored by the public, and a number of decorative varieties have been used lately. The mottled leather known as Spanish brown is extremely popular, and is a very good material, as it shows dirt scarcely any more easily than black. But leather is scarce, and at far the highest price it has ever seen; the shoe trade troubles are common property now. A surprising amount of material is needed to cover the seats, the back cushions and the doors of an automobile. When it is necessary to multiply 200 sq. ft. or so by 35 or 40 cents in order to get the leather cost per car, the seriousness of the situation is obvious.

Economy with Leather Needed

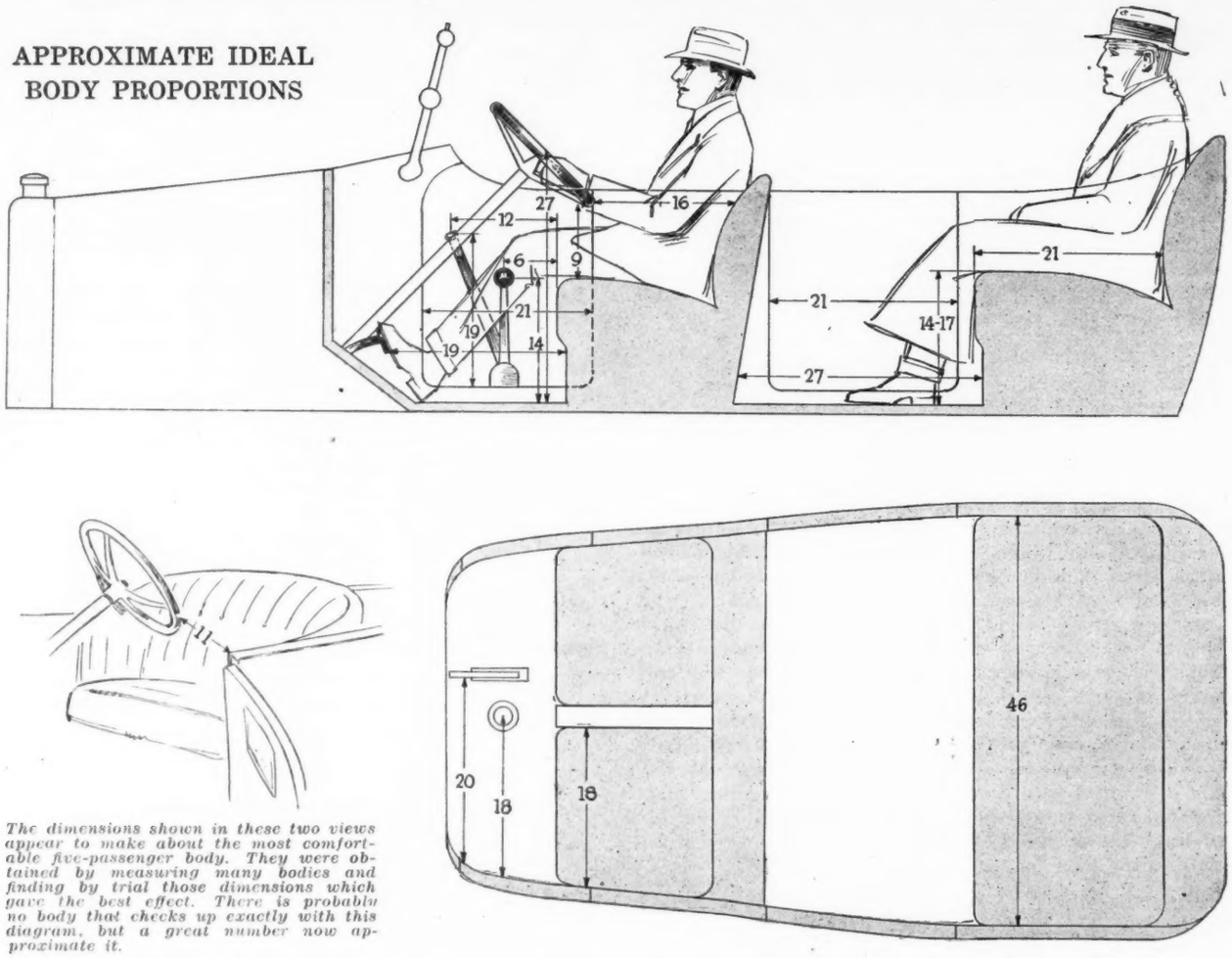
Thus a careful examination of very many cars will show that the leather used for the seats and cushions is not the same as that which covers the doors and, perhaps, lines the cowl. To use good leather in places where it will be subject to wear and imitation leather in other locations does not injure the appearance of the job, for imitation leathers are now made with almost all the qualities of the genuine article. Still the time is coming when it may be cheaper to make lavish use of polished wood inside a body rather than employ genuine leather.

Scarcity of genuine leather and its immense price have, of course, made it an impossible material for a very low priced car, and other materials such as DuPont Fabrikoid have enjoyed a large sale.

More Colored Cars

Externally color has returned to favor, as predicted by THE AUTOMOBILE a year ago. Blues, greens and reds, usually in dark shades, are to be found as stock colors in the catalogs of many manufacturers. Those firms who offer color options have found that their customers have not been slow to take advantage of the privilege. There are very many instances of colored bodies with black running gear and black fenders, but there is an inclination to have a colored hood to match the body rather than to use black for this part also. Very many cars do have the black hood with a colored body, however, and with some colors it looks well. Usually, though, the colored hood gives the smarter appearance. Plated radiators are scarce, black or color being most favored; in fact, there is very little brass or plate about a car now. Black-covered handles for the door catches, black steering columns and aluminum control levers have reduced plating to a minimum.

In passing it may be remarked that it is curious that the use of celluloid coating for protecting metal seems to be neglected by the American automobile industry. In France and England the conventional steering wheel has the rim covered with a thick deposit of black celluloid having a heavy, ribbed pattern which gives a good grip to the hand. The spokes of the steering wheel are coated similarly, even the



The dimensions shown in these two views appear to make about the most comfortable five-passenger body. They were obtained by measuring many bodies and finding by trial those dimensions which gave the best effect. There is probably no body that checks up exactly with this diagram, but a great number now approximate it.

brake and gear levers are sometimes treated with celluloid also. The coating is of good thickness, so that it is able to withstand years of wear; its appearance never changes, and it is absolutely impervious to moisture. There seems to be an opportunity here for developing a new branch of the industry.

Mention of door handles recalls another point, which is that it is rather strange there are not more new cars with external handles. The concealed handle is neat enough, and it was created so as to avoid the smallest excrescence outside a streamline shell, but the outside handle is much more useful than the other sort. We are now reduced to leather flaps outside to protect the paint from the grip of the hand in shutting the door, and these are far less esthetic in appearance than in a neatly designed handle. When the top is up and the curtains drawn the absence of an exterior handle is a nuisance; it is time that the outside handle came in again.

Sloping Windshield Popular

Following the lead of a very few, there are now many manufacturers who have adopted a sloping windshield. This is almost entirely a matter of looks, since the effectiveness of a sloping shield is little greater than that of a vertical one. It has one engineering advantage, this being that it reduces the length of the top 6 inches or so, and thus saves a pound or two of weight. It also is thought to create slightly less back draught in the rear seats, owing to its tendency to shoot the air overhead. To get much effect of this sort, however, the slope has to be very pronounced.

It is strange that the tonneau shield is not yet to be found as stock equipment on any car. It folds away neatly against the back of the front seat, and it has only to be used once to be ever afterward demanded by the tonneau passengers. It is not expensive, and it is not heavy. One day it is bound to come in and it is surprising that the day seems so long in arriving.

Tops Are Lighter

Tops are tending to be lighter. The old-fashioned top consisted of two layers of material, each being thick and massive. Now there are many cars with only one thickness of material, just as waterproof, less attractive to dust, and a good third lighter. Khaki material, along with color finish, is increasing in popularity, especially on expensive cars and cars for which distincitiveness is sought. The khaki top is just about as serviceable as the black, since it is no more liable to stain. It has the advantage of not showing dust, even though it can be stained by oil; but oil at once attracts dirt, so a khaki top stains dark where a black top stains light. On the whole there is nothing to choose on this score, and he who prefers the lighter material need have no fear as to its lasting ability.

The demountable top, which is a semi-permanent roof with insertable glass windows, seems to have made a real hit with the buying public, and it is a type now cataloged by a large number of makers. There are all sorts of these tops, some neat and effective, some pretty poor jobs, but the average of engineering shown in the winter tops of 1917 is vastly ahead of that to be observed at the show last year. The expensive, Springfield type is apparently regarded as the highest expression of the art, and there are many cars now to be seen that can hardly be distinguished from permanently closed

cars. It is a type of body that combines so many qualities that plenty of people are willing to pay the necessary price.

The people who buy the better grade cars, those selling from $1,000 to $2,000 are mostly willing to give a hundred or two extra for a really well finished body. If the cars of 1916 have been criticised by their owners, they have suffered more from complaint regarding the finish and the detail of their bodies than from any other cause. The man who can pay say $1,500 can just as easily pay $1,600, and he is willing enough to do it if $75 extra is put into the body by the manufacturer. Individually, manufacturers are, of course, seldom willing to allow this, but it is the only thing that can explain some of the great improvements that are to be observed in the body equipment of the 1917 cars.

Few New Constructions

In body construction there has been little change. The usual body had a wood frame and panels of sheet steel. Aluminum is used, for lightness sake, where the price of the car permits. Dodge, still employs the sheet steel body that is made of numerous pressings welded together in a huge frame, and has practically no more wood work than is necessary for the attachment of the upholstery. This system can be employed only where the quantities are absolutely huge, as the first cost is immense, and to change a design in the least detail even, becomes a very serious consideration. Still it makes a strong body of light weight, and one that is not liable to loosen up after a year of use, so the system is deserving of greater development. Pierce-Arrow use cast aluminum bodies still, but have no imitators yet, excepting Cadillac who are using cast bodies for some of the closed cars. This casting process makes the most durable body possible by any system, and it has been a good deal neglected, since it is not a very costly process of body building when developed. A new firm in Detroit is now specializing on this cast body, and extended use of it is to be anticipated in the future, when aluminum is cheaper.

Cloverleaf Developed

There are no new types of body this year. At the 1916 shows the cloverleaf three- or four-seated body was practically new, and it attracted a good deal of attention, but this year we have many improved cloverleaf designs, and a good many small tonneau four-passenger jobs. One or two makers have four-seated cars with but two doors, these being of exceptional width so that they give access to both front and rear seats. This latter is a very much used type in England, and it is convenient, while looking very smart. The only necessary is that the construction be rigid enough to permit the wide door opening without the risk of producing rattle. The deeper frames and generally stiffer chassis of 1917 will make it easier to use bodies with wide doors.

Divided Front Seat Matter of Choice

There has been no landslide toward the divided front seat. It is comfortable, but it does make the total width of the body greater, and it takes away a brace across the body which is of assistance in maintaining the staunchness of the whole frame. Divided front seats usually call for an extra wide windshield, so altogether they cost rather more than the older style, and are liable to be a little heavier. For a real luxury car they are eminently suitable, and also for a close coupled job where the absence of the bracing at the center does not matter, owing to the short overall length. Some people prefer them, others do not, so it seems almost certain that we shall have the new style and the old both with us for a long time to come.

When the divided front seat is used there is an opportunity for making both the driver's and the front passenger's seat adjustable. To do so adds but little to the weight and does not diminish the strength. Curiously this development has only been considered by a very few manufacturers indeed.

As regards closed bodies, it was remarked last year that these were more in demand than ever, and the same holds true to-day. The demountable top seems to have given the user a taste for a closed car, shown him its advantages, as it were. So a majority of manufacturers are now able to supply closed cars in one or more styles. There are few, if any, completely new types, but the sedan or inside drive body seems to be one of the most in demand. The extent to which these sedans are appearing on low priced chassis is remarkable. The output of Ford sedans must equal the total production from many a good sized factory, and there are plenty of others.

These cars appeal as much to the country as to the city; where there is school for the children or shopping for the women some miles from the farm, the inexpensive sedan is more appreciated than it is in places where a street car is waiting at the next corner. The open car is the car for touring; there is no doubt whatever about this. It is the car *par excellence* for pleasure riding in the summer, but the closed car is the real utility machine. To-day the ordinary man has an open car, and a closed one if he thinks he can afford it. It seems possible that the reverse may come to be true; that a man will buy a closed car if he has just the one, and will add an open model for summer luxury if his pocketbook be fat enough. Getting down to a quantity production basis, the closed car can be made cheaply and quite well.

Permanent Top Coming

It seems very probable that the next few years will see a great change in the methods of making closed bodies. It should be possible to construct a closed car almost as cheaply as an open one, if the necessary plant were installed. The art of producing open bodies at low cost has been developed to a high pitch of efficiency and the demand for closed cars is only just beginning to grow large enough to enable the body builders to contemplate the long series of repetition work which is the first essential before laying down new machinery.

On the other hand, if it is found that the body with a permanent roof like the Springfield, and with detachable window glasses, is as cheap to construct as the regular closed car, it may be that the Springfield type will come more into favor than the entirely closed car. It has all the advantages of the latter and some of the main features of an open car also. One thing seems fairly clear, and this is that the conventional folding top as we have it on the touring cars of 1917 will vanish in course of time. It is clumsy, even the cleverest one-man designs are unornamental, and side curtains are a makeshift of poor efficiency for excluding drafts. The automobile body has never been a real piece of engineering except in a few isolated instances. When it gets the same attention as the chassis has had it will be improved rapidly, and there are signs that the attention is going to be given soon.

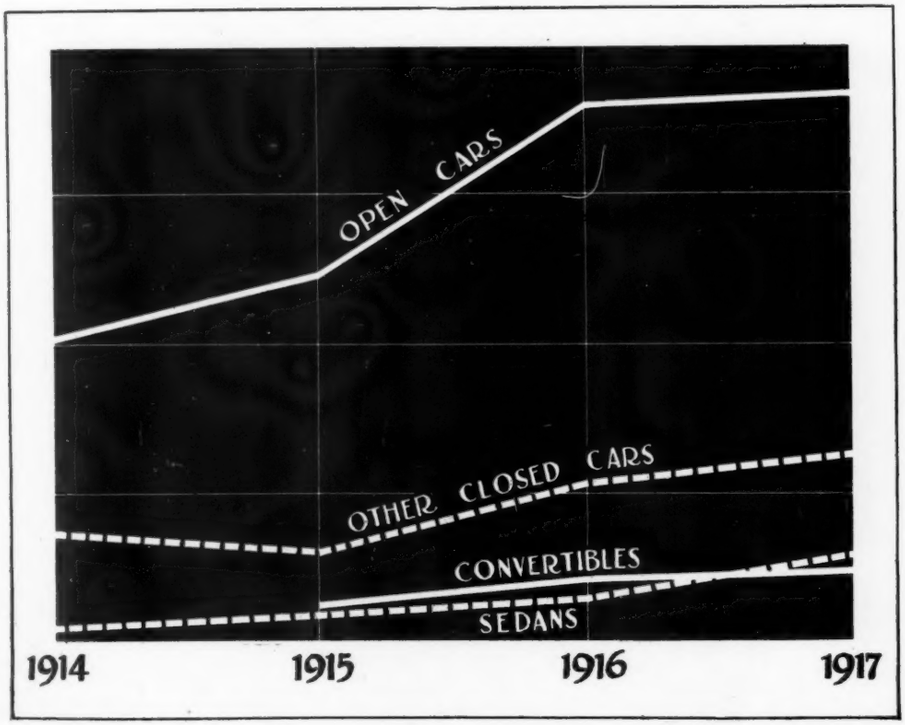
Will Be Lighter

Several times in automobile history there have been made attempts to utilize the body by making it act as a part of the frame. There is a great deal of strength capacity in the panels of a body that is being put to no use whatever, and this has occasionally caused a bold engineer to try and make the body and frame in one piece. The Brush frame is a step in this direction, for it eliminates the body sills and this design bids fair to be more successful than any of the other attempts. As long as any material is being carried which is not working, a car must weigh more than it need do theoretically. Of course, a good deal of waste weight will never be avoided, but so much of it as is found in the present type of body cannot be permitted forever.

Probably, however, we shall see only slow development in this direction.

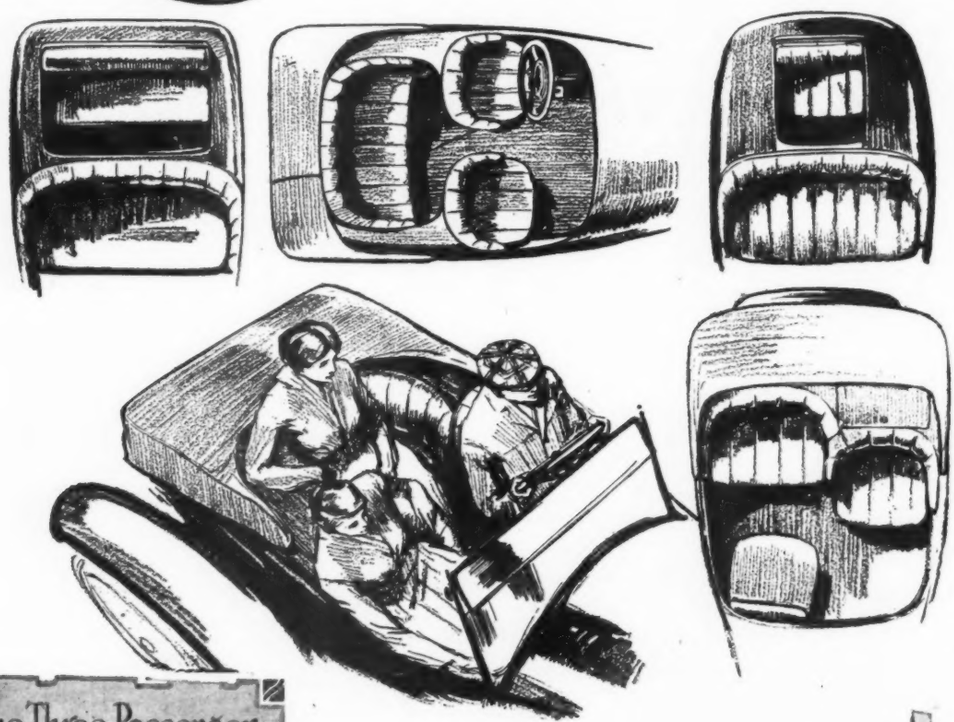
THE AUTOMOBILE ILLUSTRATED

1917 Models

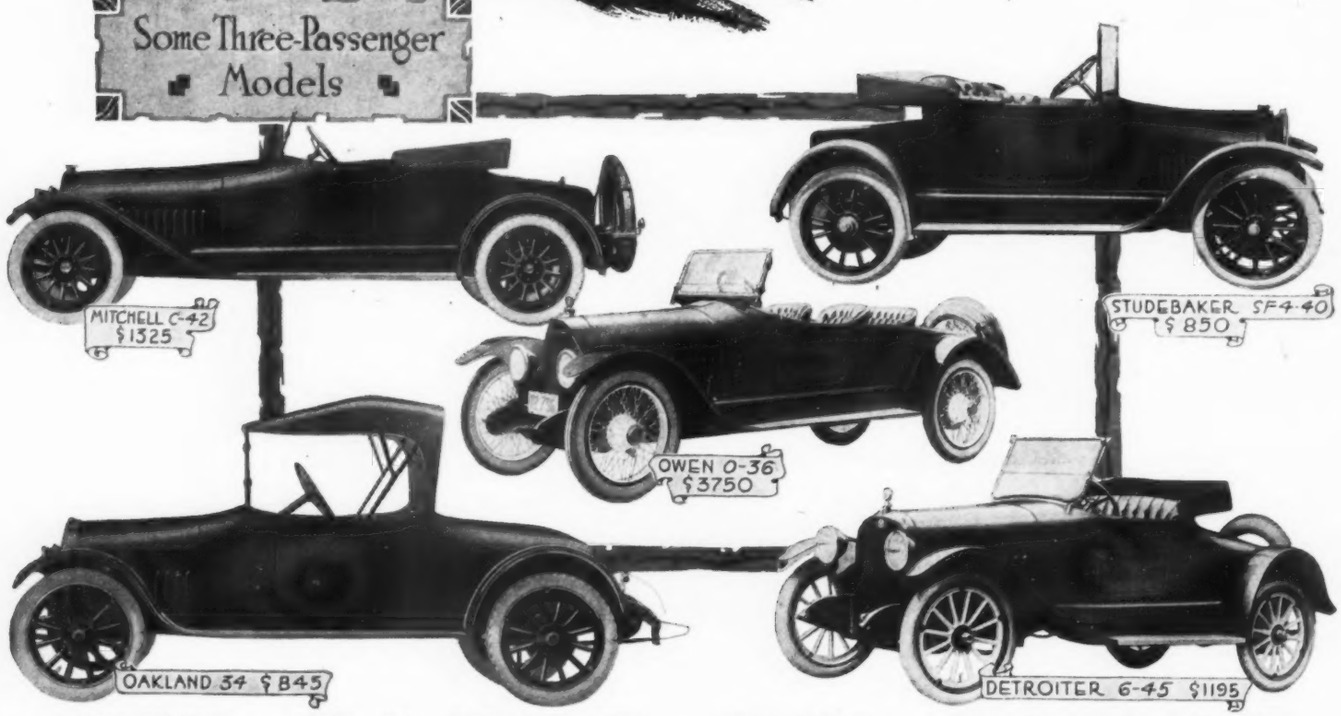


Some of the prices on the following pages, in addition to those noted, have been changed. These new prices were announced too late to permit of their insertion.

Roadsters and Runabouts



Some Three-Passenger Models



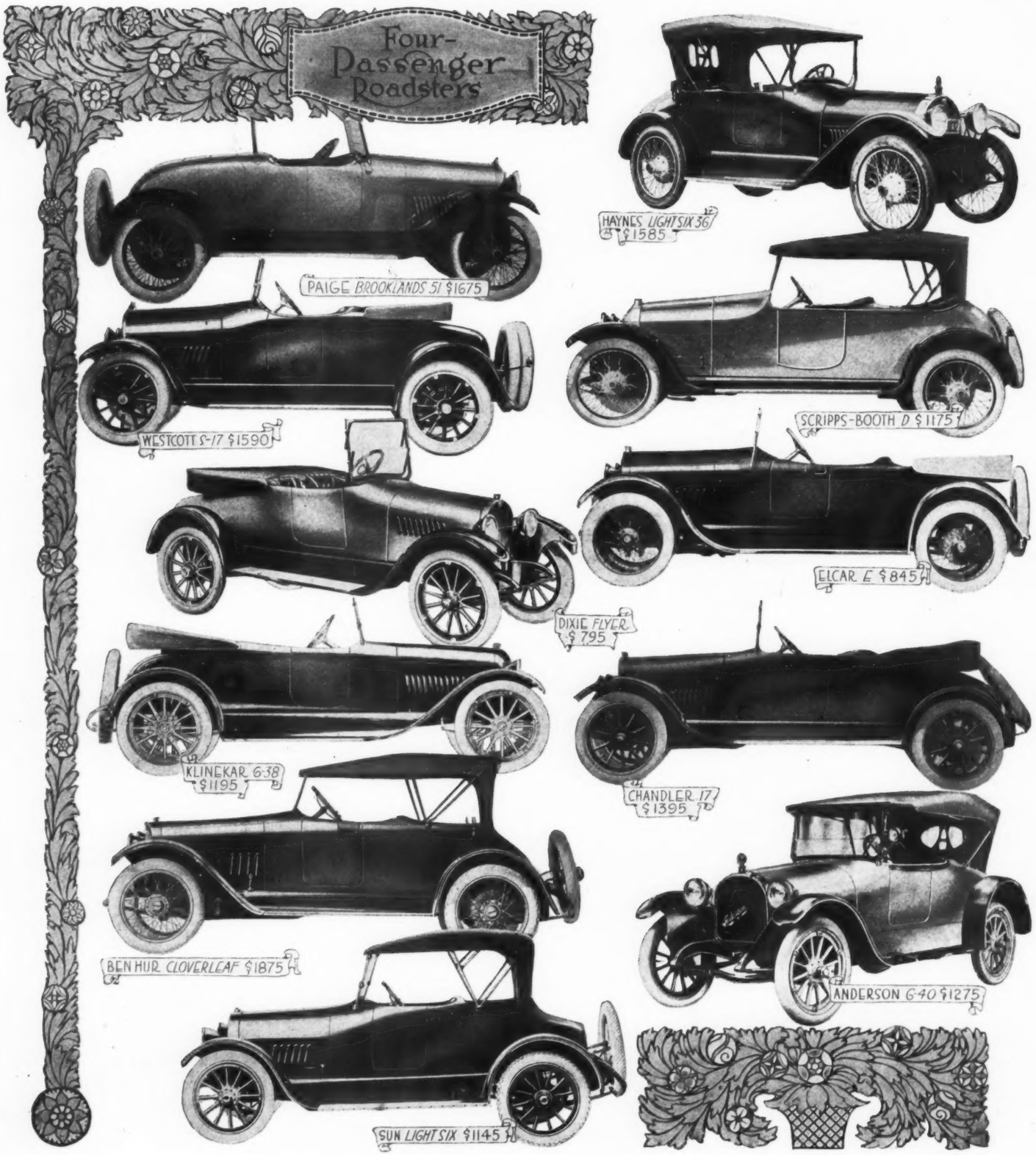
Name and Model	Price	Cyl.	H. P.	W. B.	Tires
Detroiter, 6-45	$1195	6	25.35	119	33x4
*Mitchell, C-42	1425	6	29.40	127	34x4
*Oakland, 34	875	6	18.99	112	32x4
Owen, Mag. O-36, Cloverleaf.	3750	6	33.75	136	35x5
*Studebaker, 4-40	$ 930	4	24.03	112	34x4
Studebaker, 6-50	1170	6	36.04	122	34x4

*Later price than shown in illustration.

Name and Model	Price	Cyl.	H. P.	W. B.	Tires
Apperson Roadaplane, 8-17, Chummy	$2000	8	31.25	130	35x4½
Apperson Roadaplane, 6-17 Chummy	1750	6	29.40	130	34x4
Auburn, 6-39, Chummy	1085	6	23.44	120	34x4
Cadillac, 55, Club	2080	8	31.25	125	36x4½
*Cole Tuxedo 861	1695	8	39.20	127	35x4½
Elgin Six	985	6	21.60	116	33x4
Jackson, Wolverine	1395	8	28.80	118	34x4

Name and Model	Price	Cyl.	H. P.	W. B.	Tires
Laurel, 35, Cloverleaf	$ 895	4	22.50	112	....
Liberty Six, Close-Coupled	1095	6	23.44	115	32x4
Marmon, 34, Club	3100	6	33.75	136	34x4½
Paterson	1095	6	25.35	117	32x4
Pilot, 6-45	1150	6	23.44	119	32x4
Premier	1895	6	27.34	125½	35x4½
Standard Eight, Cloverleaf	1850	8	28.80	...	35x4½

*Later price than shown in illustration.

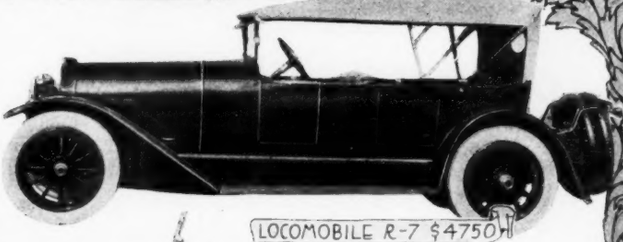


Name and Model	Price	Cyl.	H. P.	W. B.	Tires
Anderson, 6-40	$1275	6	25.35	120	33x4
Ben-Hur, Cloverleaf	1875	6	29.40	126	35x4½
Chandler, 17	1395	6	27.34	123	34x4
Dixie Flyer, Cloverleaf	795	4	16.90	112	32x3½
Elcar, Cloverleaf	845	4	19.60	115	32x3½
Haynes Six, 36	1585	6	29.40	121	34x4
Haynes Six, 37	$1685	6	29.40	127	35x4½
Haynes Twelve, 41	2185	12	36.30	127	34x4½
KlineKar, 6-38, Shamrock	1195	6	25.35	120	34x4
Scripps-Booth, D	1175	8	22.05	120	32x4
Sun Six	1145	6	23.44	116	34x4
Westcott, S-17, Cloverleaf	1590	6	29.40	125	35x4½

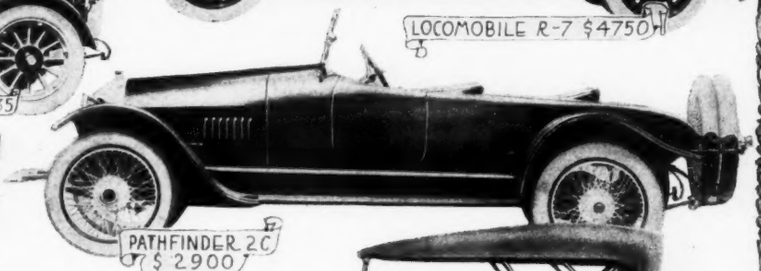
Four-Passenger Roadsters

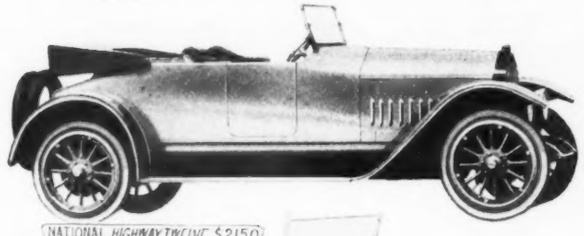
FRANKLIN SERIES 9 $1850

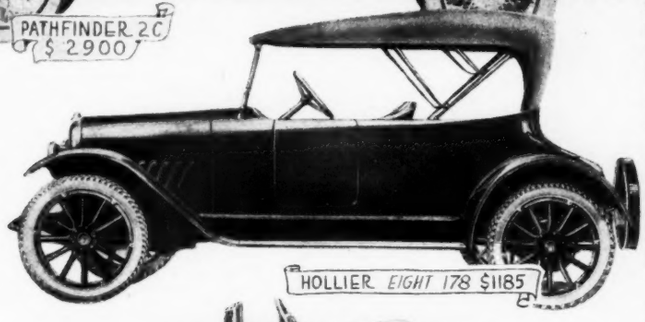
VELIE BILTWELL SIX 28 $1135

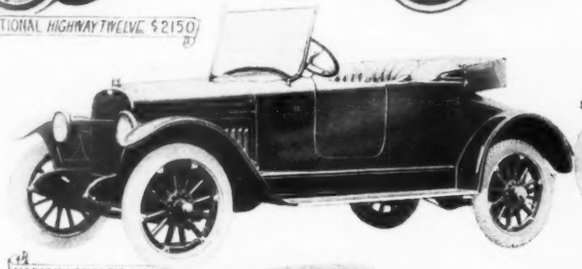

LOCOMOBILE R-7 $4750

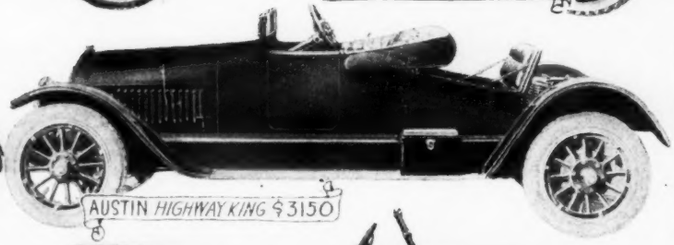
MERCER 22-73 SPORTING $3500

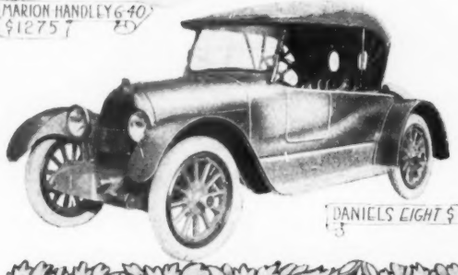

PATHFINDER 2C $2900

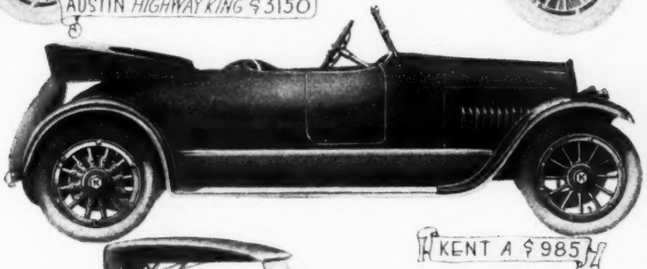

NATIONAL HIGHWAY TWELVE $2150

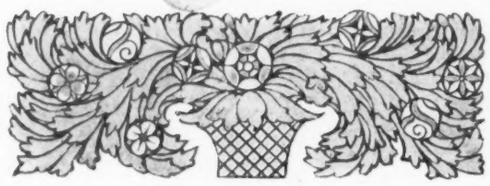

HOLLIER EIGHT 178 $1185

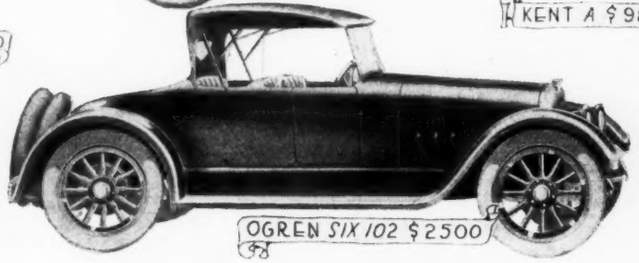

MARION HANDLEY 6-40 $1275 T


AUSTIN HIGHWAY KING $3150


DANIELS EIGHT $2700

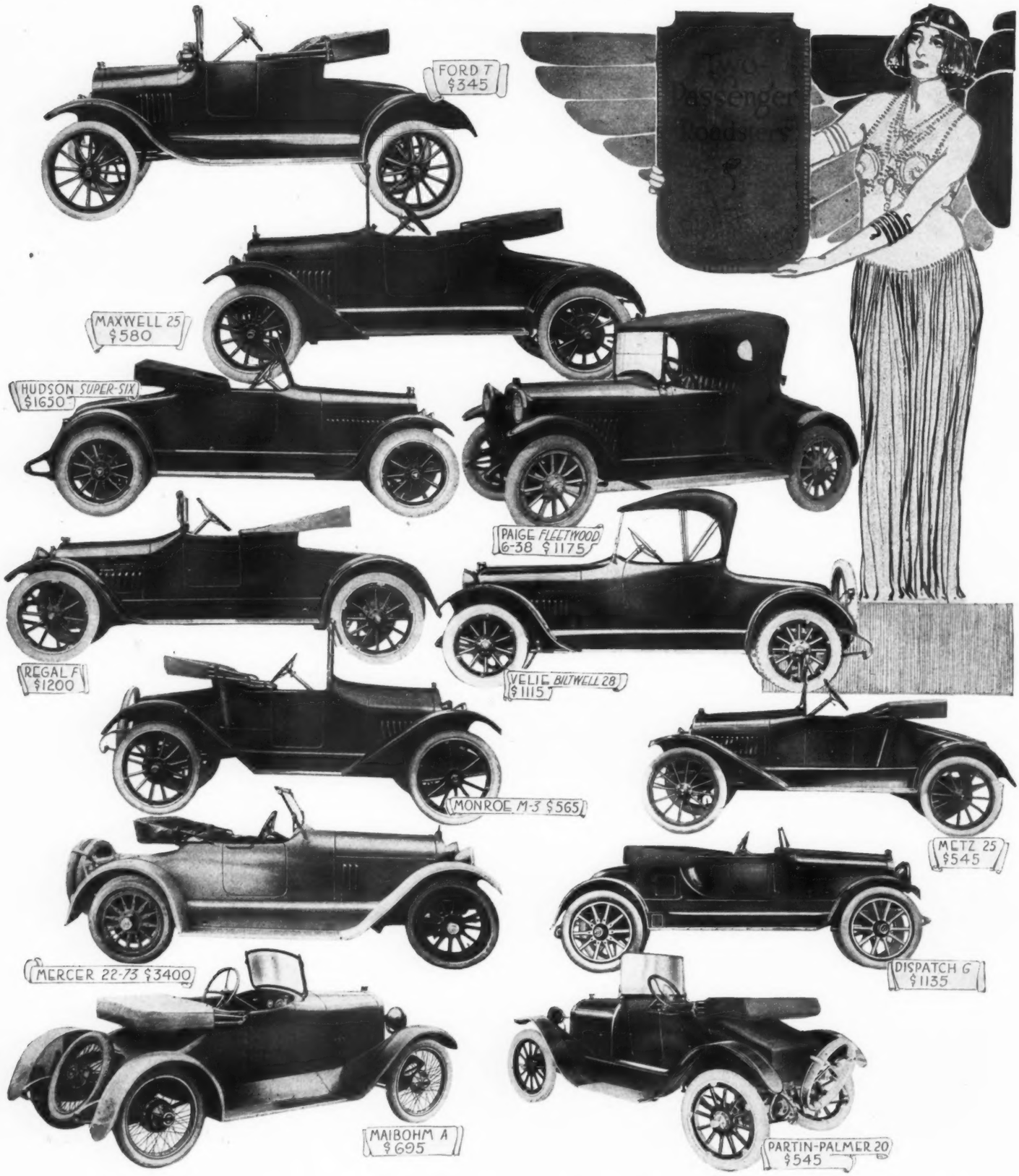

KENT A $985




OGREN SIX 102 $2500

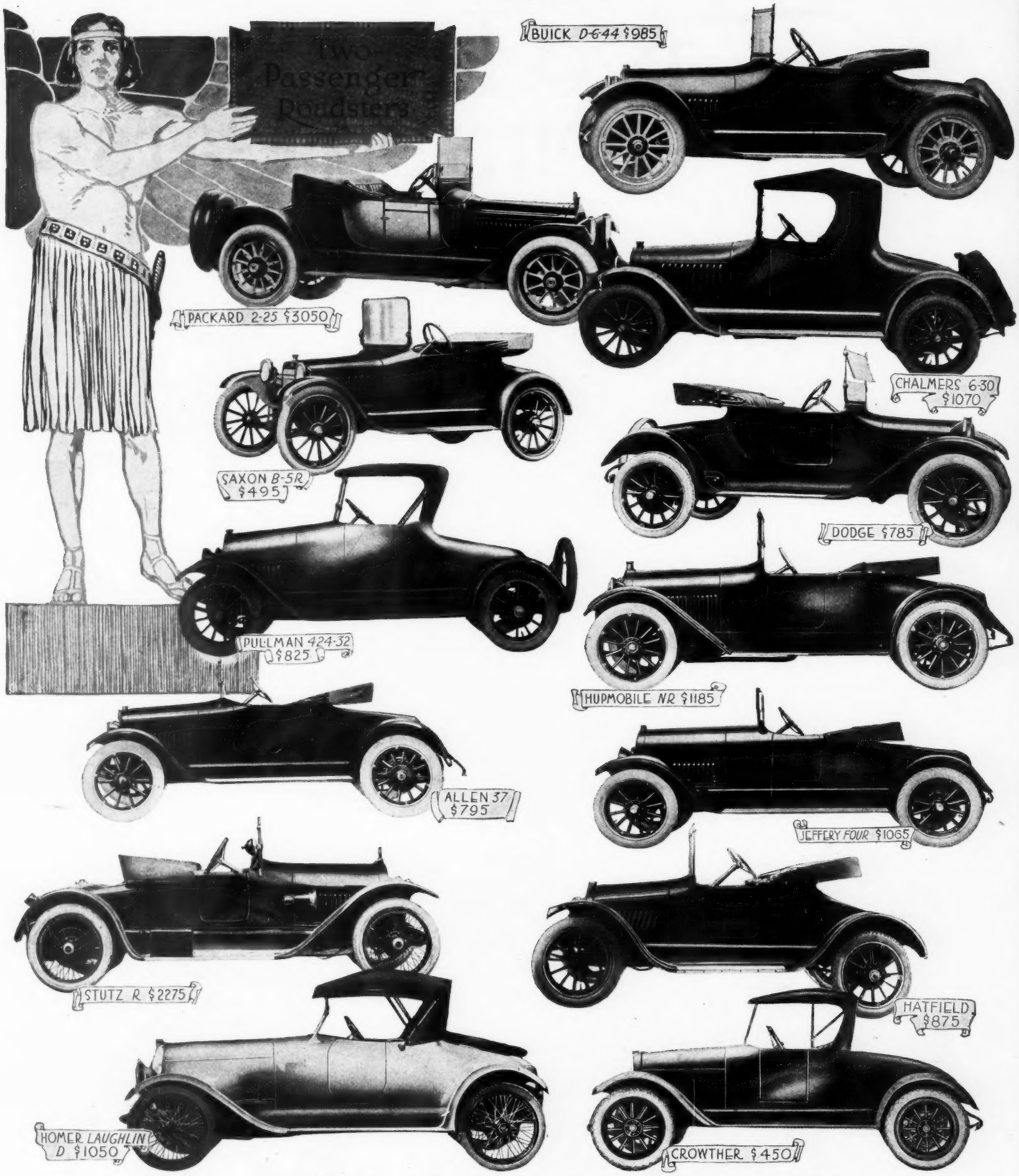
Name and Model	Price	Cyl.	H. P.	W. B.	Tires
*Austin Highway King	$3750	12	39.68	142½	34x4½
Daniels Eight	2600	8	33.80	127	34x4½
Daniels Eight, Cloverleaf	2700	8	33.80	127	34x4½
Daniels Eight, Close Coupled	2800	8	33.80	127	34x4½
Franklin, Series 9	1850	6	25.35	115	32x4
Hollier Eight	1185	8	28.80	116	34x4
Kent, A	985	4	22.50	116	32x4
Locomobile, 38, R-7	4750	6	43.55	139	37x5
Marion-Handley, 6-40	1275	6	23.44	120	32x4
Mercer, 22-73, Sporting	$3500	12	22.50	132	34x4½
National Highway Twelve	2150	12	39.68	128	34x4½
National Highway Six	1750	6	29.40	128	34x4½
Ogren Six, 102	2500	6	33.75	132	34x4½
Pathfinder, 2 C	2900	12	39.68	130	35x5
Velie Biltwell Six, 28	1135	6	25.35	115	32x4

*Later price than shown in illustration.



Name and Model	Price	Cyl.	H. P.	W. B.	Tires
Dispatch, G	$1135	4	22.50	120	30x3½
Ford, T	345	4	22.50	100	30x3½
Hudson, Super-Six	1650	6	29.40	125½	35x4½
Maibohm, A	695	4	15.63	105	30x3½
Maxwell, 25	580	4	21.03	103	30x3½
Mercer, 22-73, Runabout	3400	4	22.50	115	32x4
Mercer, 22-73, Raceabout	3250	4	22.50	115	32x4

Name and Model	Price	Cyl.	H. P.	W. B.	Tires
Metz, 25	$ 545	4	24.03	108	32x3½
Monroe, M-3	565	4	14.40	96	30x3
Paige, 6-38, Fleetwood	1175	6	23.44	117	32x4
Partin-Palmer, 20	545	4	15.63	96	30x3½
Regal, F, DeLuxe Roadster	1200	8	28.80	115	33x4
Velie Biltwell Six, 28	1115	6	25.35	115	32x4

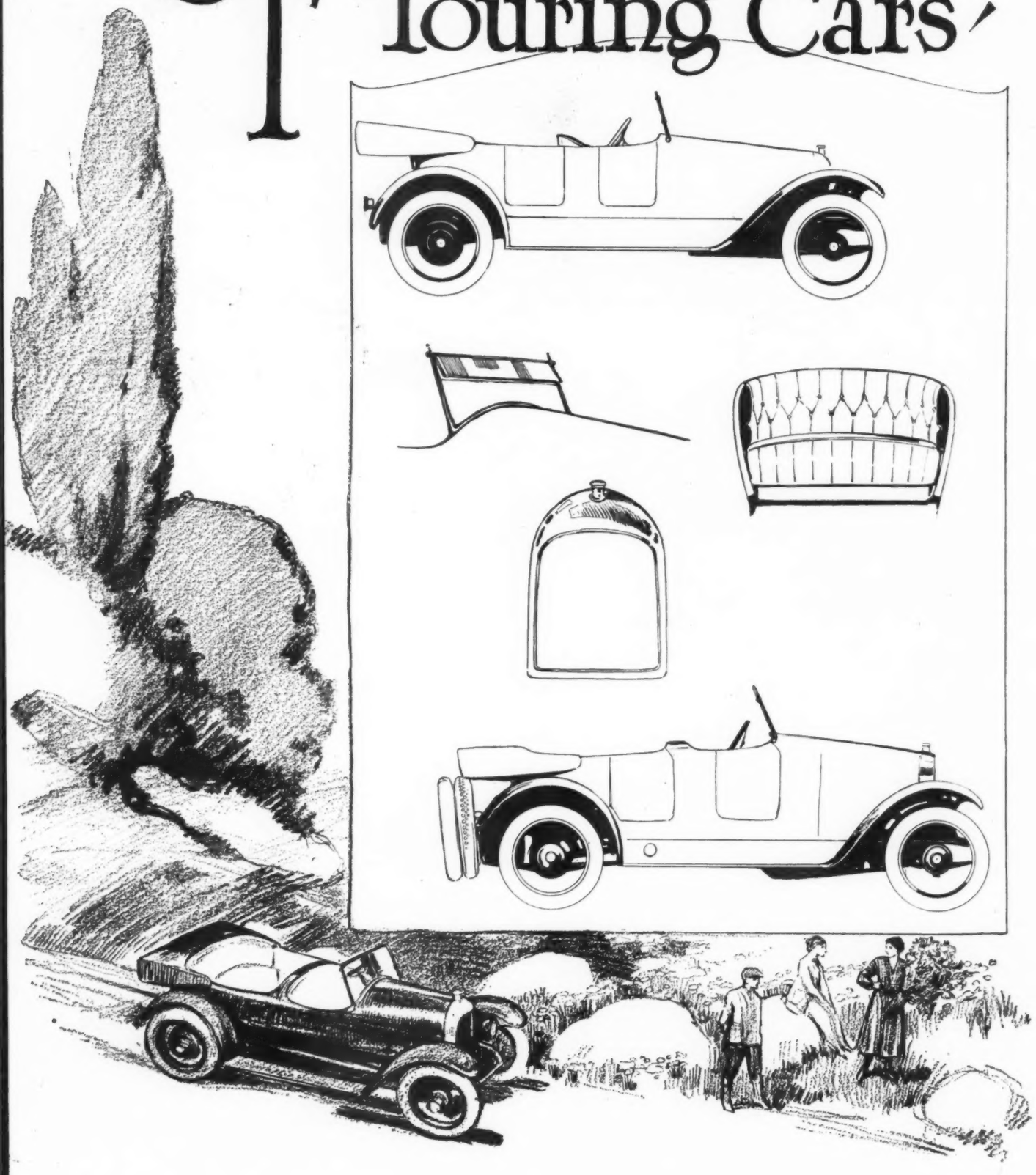


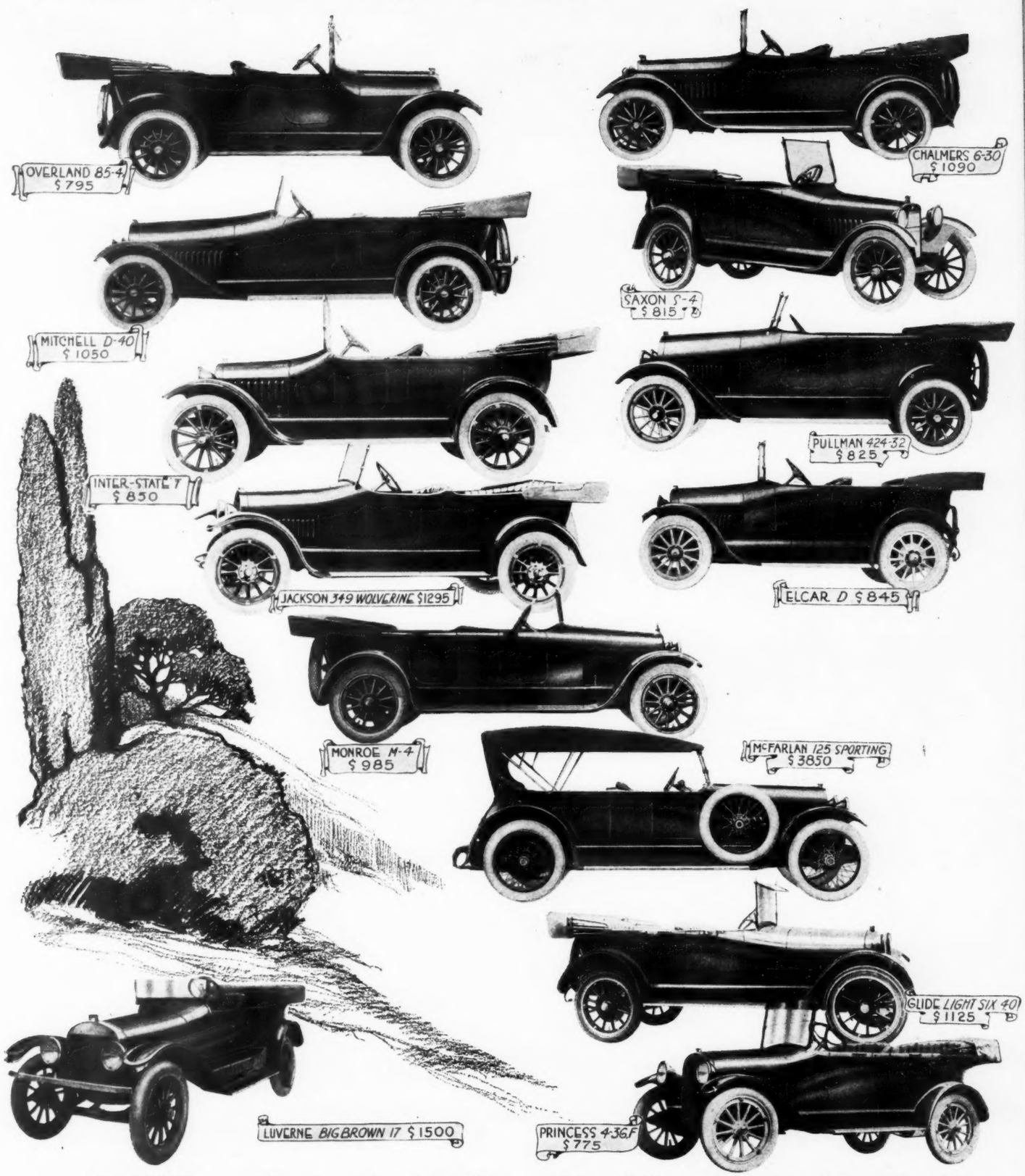
Name and Model	Price	Cyl.	H. P.	W. B.	Tires
*Buick, D-6-44	$1070	6	25.35	115	34x4
Buick, D-4-35	660	4	18.23	106	34x4
Chalmers, 6-30	1070	6	25.35	115	32x4
Crowther	450	4	22.50	110	30x3
Dodge	785	4	24.03	114	32x3½
Hatfield	875	4	22.50	106	31x4
Homer Laughlin, D	1050	8	16.26	112	30x3½
Hupmobile, NR	$1185	4	22.50	119	34x4

Name and Model	Price	Cyl.	H. P.	W. B.	Tires
*Jeffery Four	1335	4	22.50	116	34x4
Packard, 2-25, Runabout	3050	12	43.20	126	35x5
Pullman, 424-32	825	4	22.50	114	31x4
Saxon, B-5 R	495	4	12.10	96	30x3
Stutz, R	2275	4	36.10	130	34x4½

*Later price than shown in illustration.

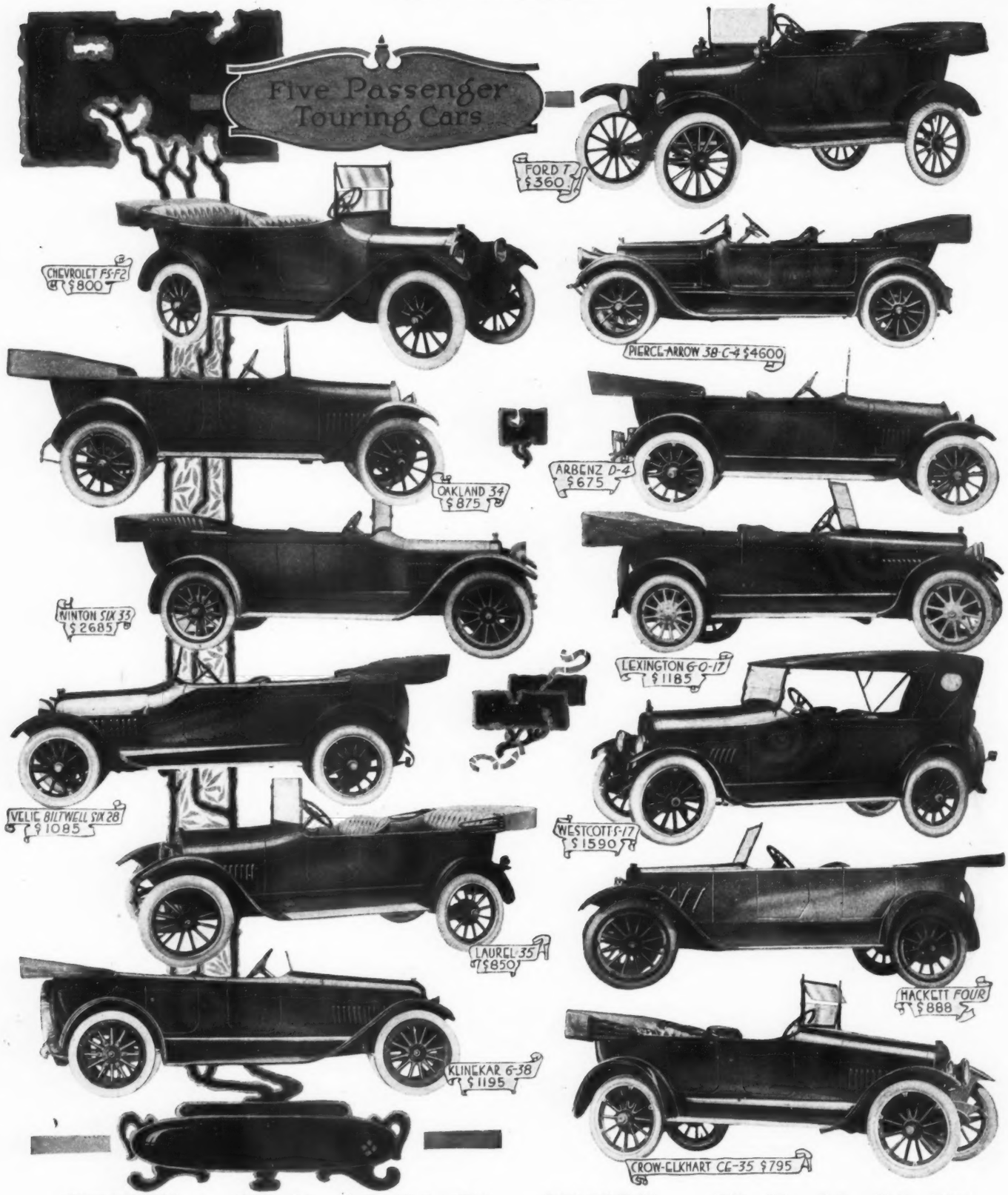
Five Passenger Touring Cars





Name and Model	Price	Cyl.	H. P.	W. B.	Tires
Chalmers, 6-30	$1090	6	25.35	115	32x4
Elcar, D	845	4	19.60	115	32x3½
Glide, Six-40	1125	6	23.44	119	34x4
Inter-State, T	850	4	19.60	110	33x4
Inter-State, T	895	4	19.60	110	33x4
Jackson, Wolverine	1295	8	28.80	118	34x4
Luverne, 17	1500	6	33.75	132	35x4½
*McFarlan, 125 Sporting	3800	6	48.60	136	35x5
*Mitchell, D-40	1150	6	25.35	120	32x4
Mitchell, C-43	$1425	6	29.40	127	34x4
Monroe, M-4	985	4	16.90	115	32x4
Overland, 85-4	795	4	27.23	112	32x4
Overland, 85-6	925	6	25.35	116	32x4
*Saxon, S-4	865	6	19.84	112	32x3½
Princess 4-36, F	775	4	22.50	108	32x3½
Pullman, 424-32	825	4	22.50	114	31x4

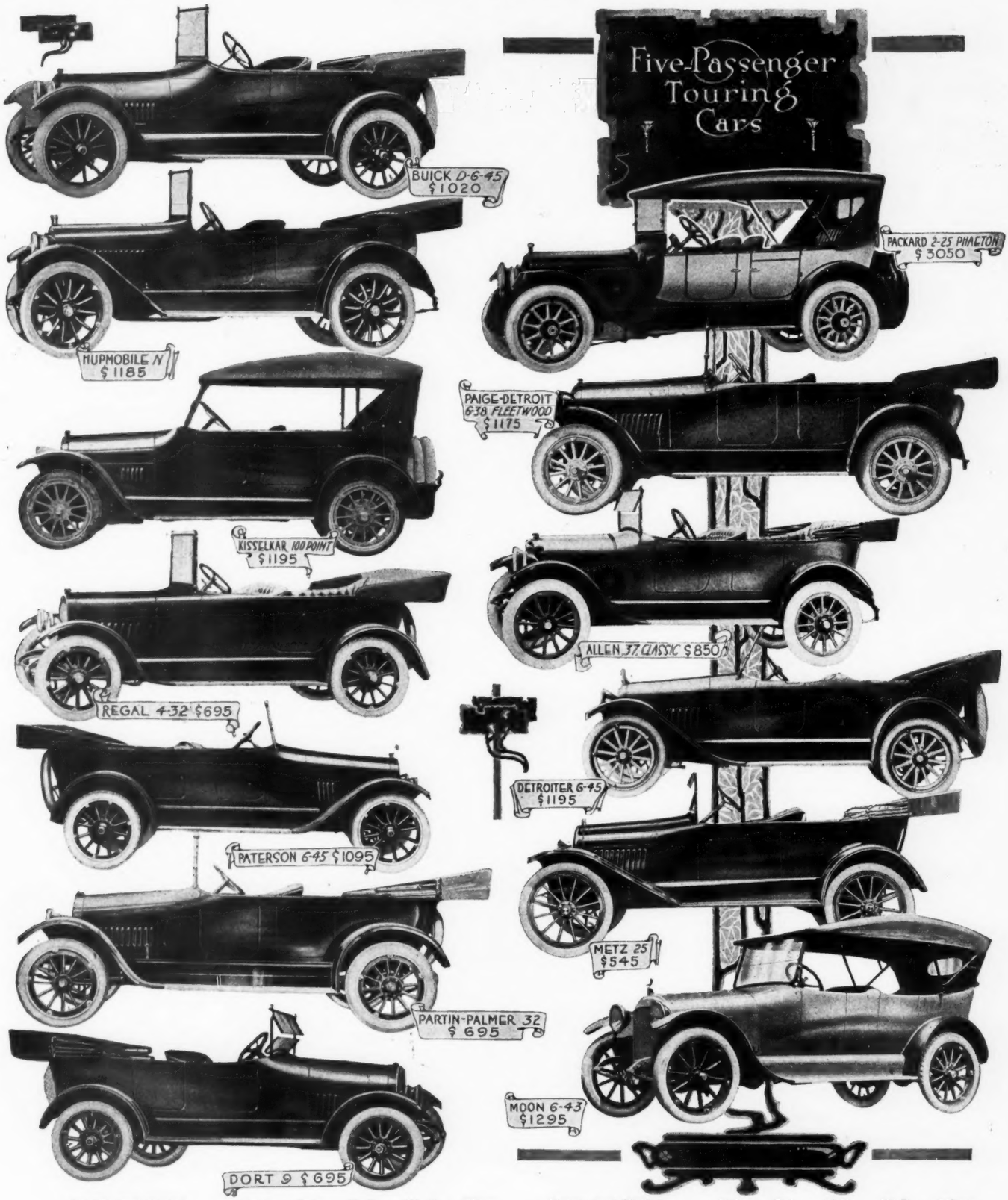
*Later price than shown in illustration.



Name and Model	Price	Cyl.	H. P.	W. B.	Tires
Arbenz, D-4	$ 675	4	16.90	108	30x3½
Chevrolet, F5	800	4	21.76	112	32x3½
Chevrolet, 490	490	4	21.76	102	30x3½
Crow-Elkhart, CE-35	795	4	19.60	113	32x3½
Ford, T	360	4	22.50	100	30x3½
Hackett Four	888	4	22.50	112	31x4
KlineKar, 6-38	1195	6	25.35	120	34x4
Laurel, 35	850	4	22.50	112	....
Lexington, 6	1185	6	25.35	116	32x4
Oakland, 34	875	6	18.99	112	32x4

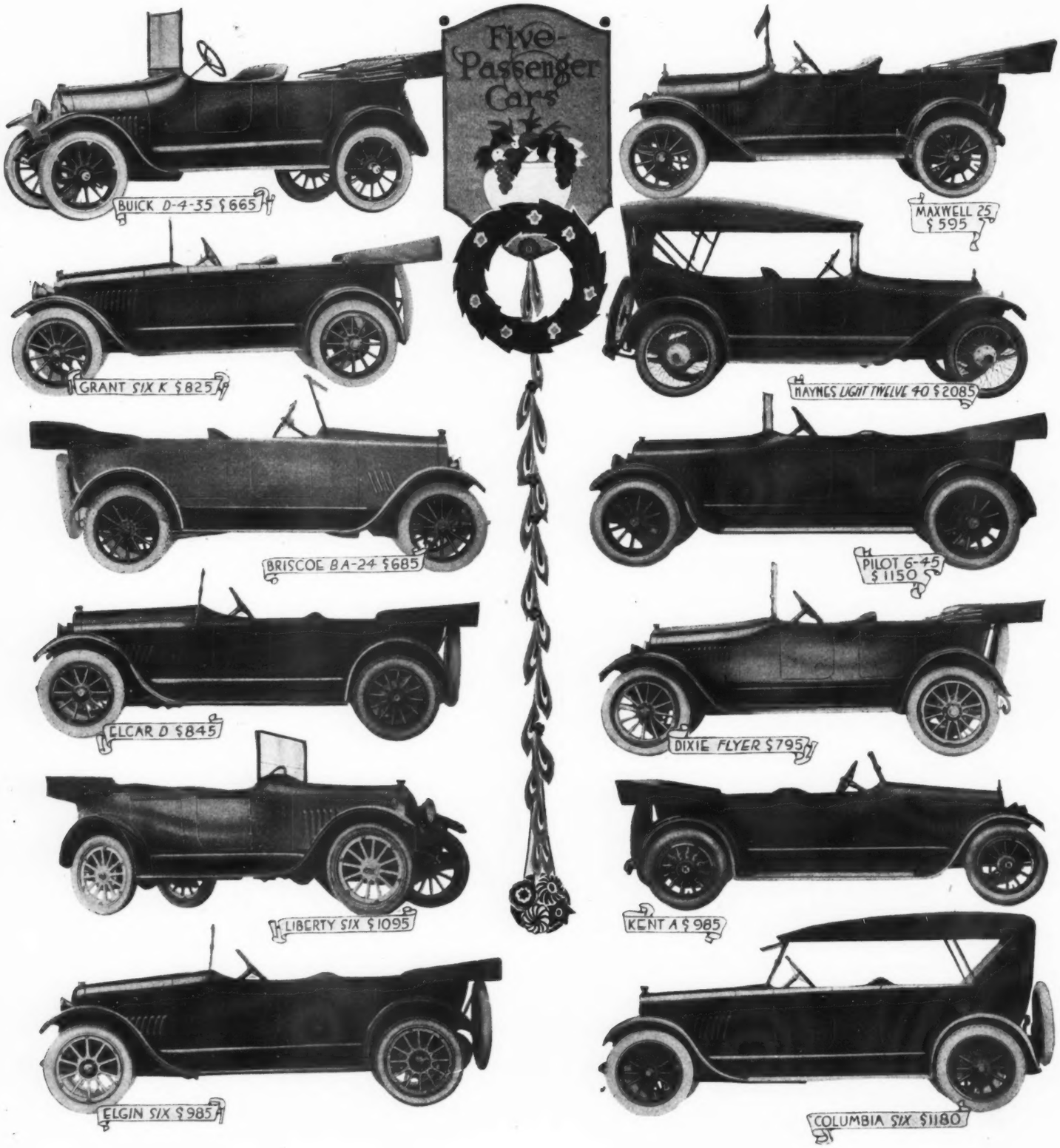
Name and Model	Price	Cyl.	H. P.	W. B.	Tires
Pierce-Arrow, 38	$4600	6	38.40	134	36x4½
Pierce-Arrow, 66	5990	6	60.00	147½	38x5½
Pierce-Arrow, 48	4900	6	48.60	142	37x5
*Velie Biltwell Six, 28	1135	6	25.35	115	32x4
Westcott, S-17	1590	6	29.40	125	35x4½
Winton Six, 33	2685	6	33.75	128	36x4½
Winton Six, 48	3500	6	43.35	138	37x5

*Later price than shown in illustration.



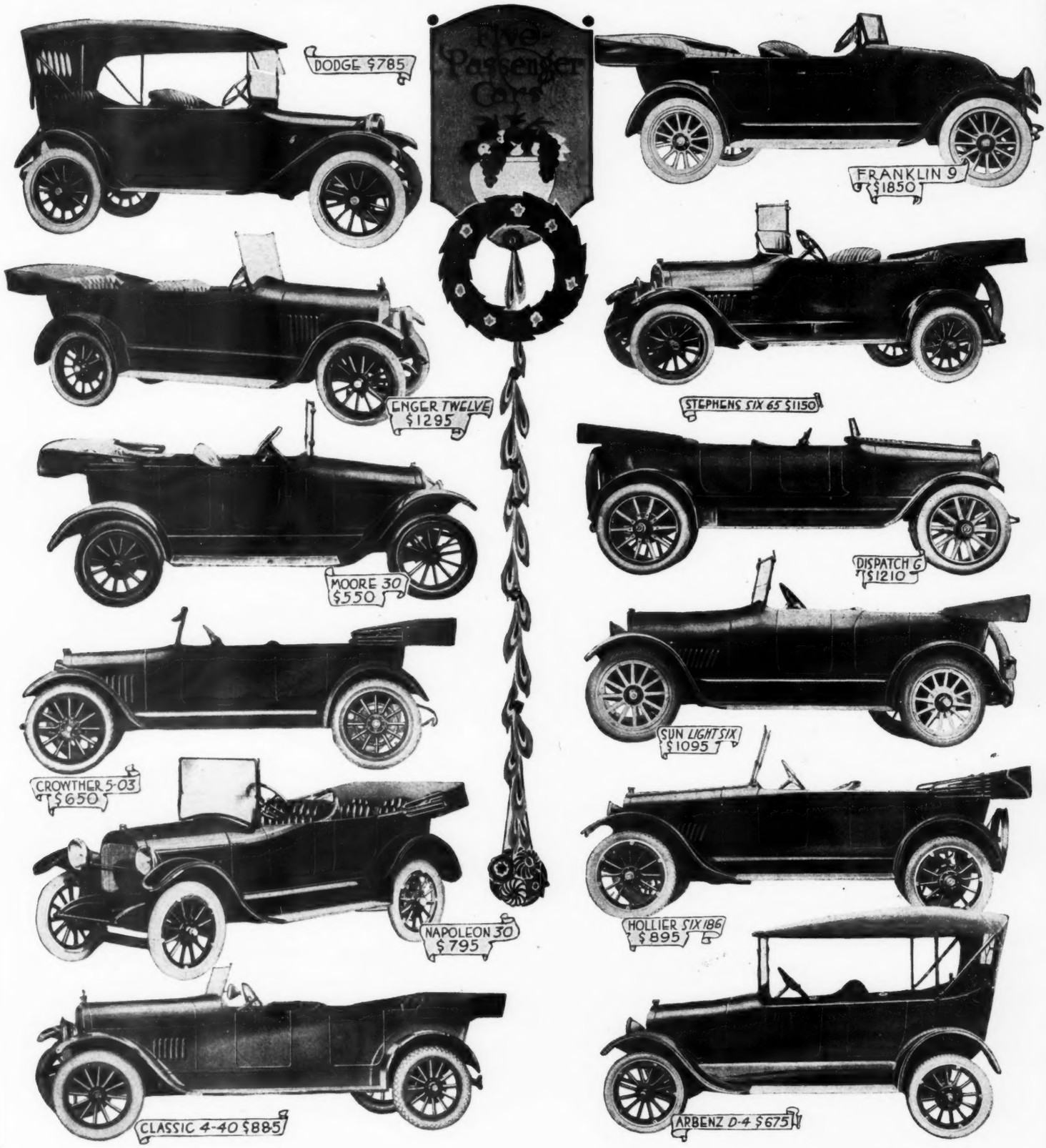
Name and Model	Price	Cyl.	H. P.	W. B.	Tires
Allen, 37, Classic	$ 850	4	22.50	112	32x3½
*Buick, D-6-45	1070	6	25.35	115	34x4
Detroiter, 6-45	1195	6	25.35	119	33x4
Dort, 9	695	4	16.90	105	30x3½
Hupmobile, N	1185	4	22.50	119	34x4
KisselKar, 100 Point	1195	6	25.35	117	32x4
KisselKar, 6-42	1650	6	31.54	128	34x4
Metz, 25	545	4	24.03	108	32x3½
Moon, 6-43	1295	6	25.35	118	33x4
Packard, 2-25, Phaeton	3050	12	43.20	126	35x5
Packard, 2-25, Salon Phaeton	$3050	12	43.20	126	35x5
Packard, 2-35, Phaeton	3500	12	43.20	135	35x5
Packard, 2-35, Salon Phaeton	3500	12	43.20	135	35x5
Paige, 6-38, Fleetwood	1175	6	23.44	117	32x4
Partin-Palmer, 32	695	4	19.60	110	32x3½
Paterson, 6-45	1095	6	25.35	117	32x4
Regal, 4-32,	695	4	19.60	108	30x3½
Regal, F	1025	8	28.80	115	33x4

*Later price than shown in illustration.



Name and Model	Price	Cyl.	H. P.	W. B.	Tires
Briscoe, B A-24	$ 685	4	15.20	105	30x3½
*Buick, D-4-35	675	4	18.23	106	31x4
Columbia Six	1180	6	25.35	115	32x4
Dixie Flyer	795	4	16.90	112	32x3½
Elcar, D	845	4	19.60	115	32x3½
Elgin Six	985	6	21.60	116	33x4
Grant Six, K	825	6	21.60	112	32x3½
Haynes Twelve, 40	2085	12	36.30	121	24x4½
Haynes Six, 36	$1585	6	29.40	121	34x4
Kent, A	985	4	22.50	116	32x4
Liberty Six	1095	6	23.44	115	32x4
Maxwell, 25	595	4	21.03	103	30x3½
Pilot, 6-45	1150	6	23.44	119	32x4

*Later price than shown in illustration.



Name and Model	Price	Cyl.	H. P.	W. B.	Tires
Arbenz, D-4	$ 675	4	16.90	108	30x3½
Classic, 4-40	885	4	19.60	114	32x4
Crowther, 5-03	650	4	22.50	110	30x3
Dispatch, G	1210	4	22.50	120	36x3½
Dodge	785	4	24.03	114	32x3½
Enger Twelve	1295	12	34.75	116	32x4
Hollier Six, 186	$895	6	21.60	116	32x3½

Name and Model	Price	Cyl.	H. P.	W. B.	Tires
Hollier Six, 178	$1185	8	28.80	116	34x4
Moore, 30	550	4	22.50	106	30x3½
Napoleon, 30	795	4	19.60	112	31x4
Overland, 85-4	795	4	27.23	112	32x4
Overland, 85-6	925	6	25.35	116	32x4
Stephens Six, 65	1150	6	25.35	115	32x4
Sun Six	1095	6	23.44	116	34x4

Name and Model	Price	Cyl.	H. P.	W. B.	Tires
American Six, A	$1285	6	21.60	122	32x4
Chicago, 6-40	985	6	23.44	120	32x4
Drexel, R-30-35	855	4	19.60	112	33x4
Drummond, 17	1600	8	28.80	120	34x4
Empire, 45	960	4	24.03	116	33x4
Empire, 70	...	6	25.35	120	34x4
F R P, 45	9000	4	33.86	140	36x5

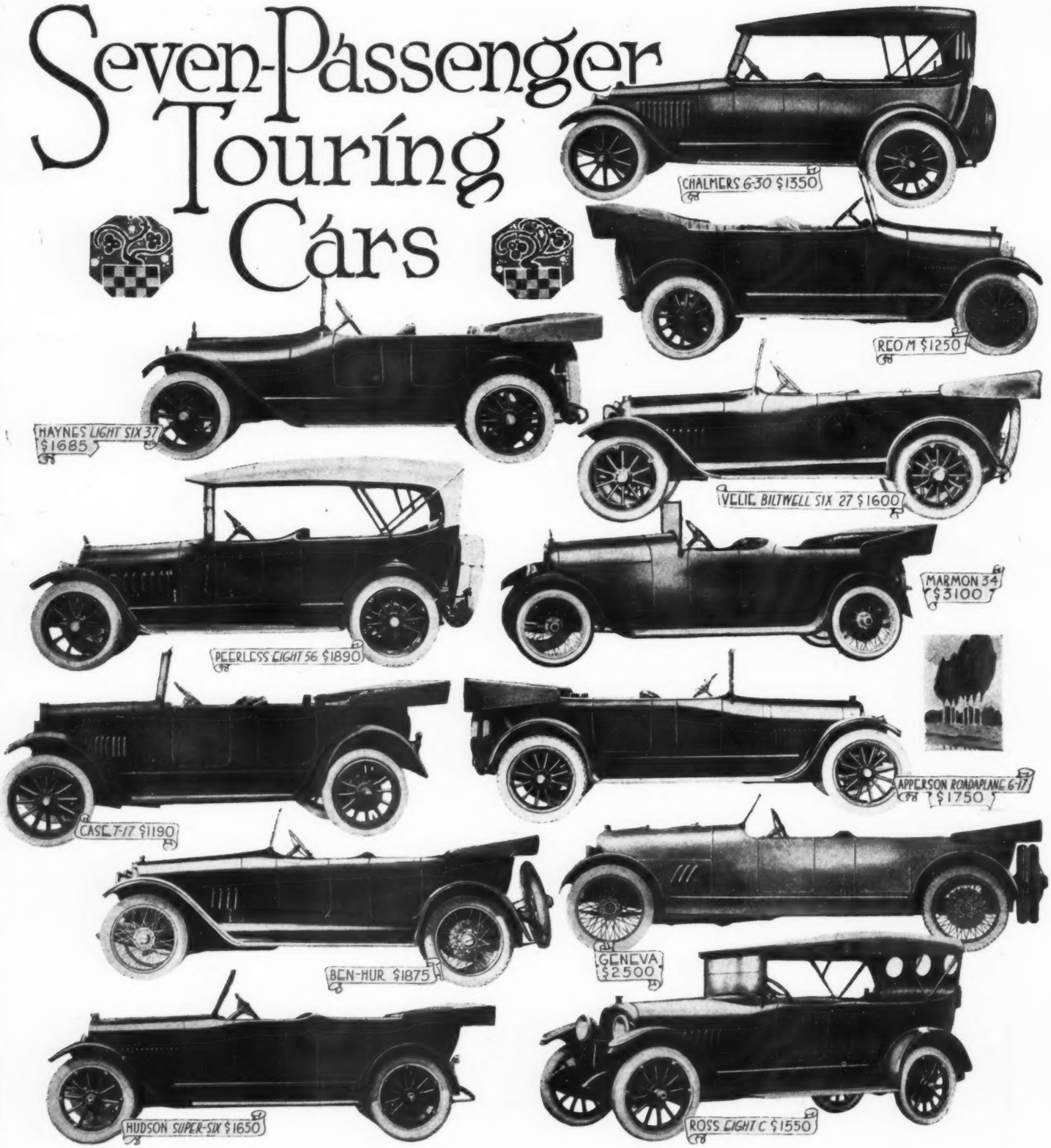
Name and Model	Price	Cyl.	H. P.	W. B.	Tires
Harroun, A-1	$ 595	4	16.90	107	30x3½
Lambert, 90	850	4	28.90	115	34x3½
Lambert, 80	985	6	25.35	112	33x4
Monitor, M	995	6	25.35	115	33x4
Monitor, C	795	4	22.50	108	32x3½
Oldsmobile, 45	1295	8	26.45	120	33x4
Owen Magnetic, M-25	3150	6	29.40	125	34x4½

FOUR-PASSENGER ROADSTERS AND FOUR-PASSENGER TOURING

Name and Mode.	Price	Cyl.	H. P.	W. B.	Tires
Biddle, D, Touring Car	$2275	4	22.50	122	32x4
Brewster, Open Phaeton	7000	4	25.60	125	34x4½
Brewster Runabout	6500	4	25.60	125	34x4½
Briscoe, B A-24	685	4	15.20	105	30x3½
Inter-State, T	895	4	19.60	110	33x4
King 8, Foursome	1585	8	28.80	120	34x4

Name and Model	Price	Cyl.	H. P.	W. B.	Tires
Moon, 6-66, Club	$1650	6	29.40	125	35x4½
Owen Magnetic, O-36, Tour'g	3750	6	33.75	136	35x5
Pullman, 424-32	825	4	22.50	114	31x4
Roamer	1850	6	23.44	124	34x4
Stutz, R, Bull Dog Special	2550	4	36.10	130	34x4½

Seven-Passenger Touring Cars



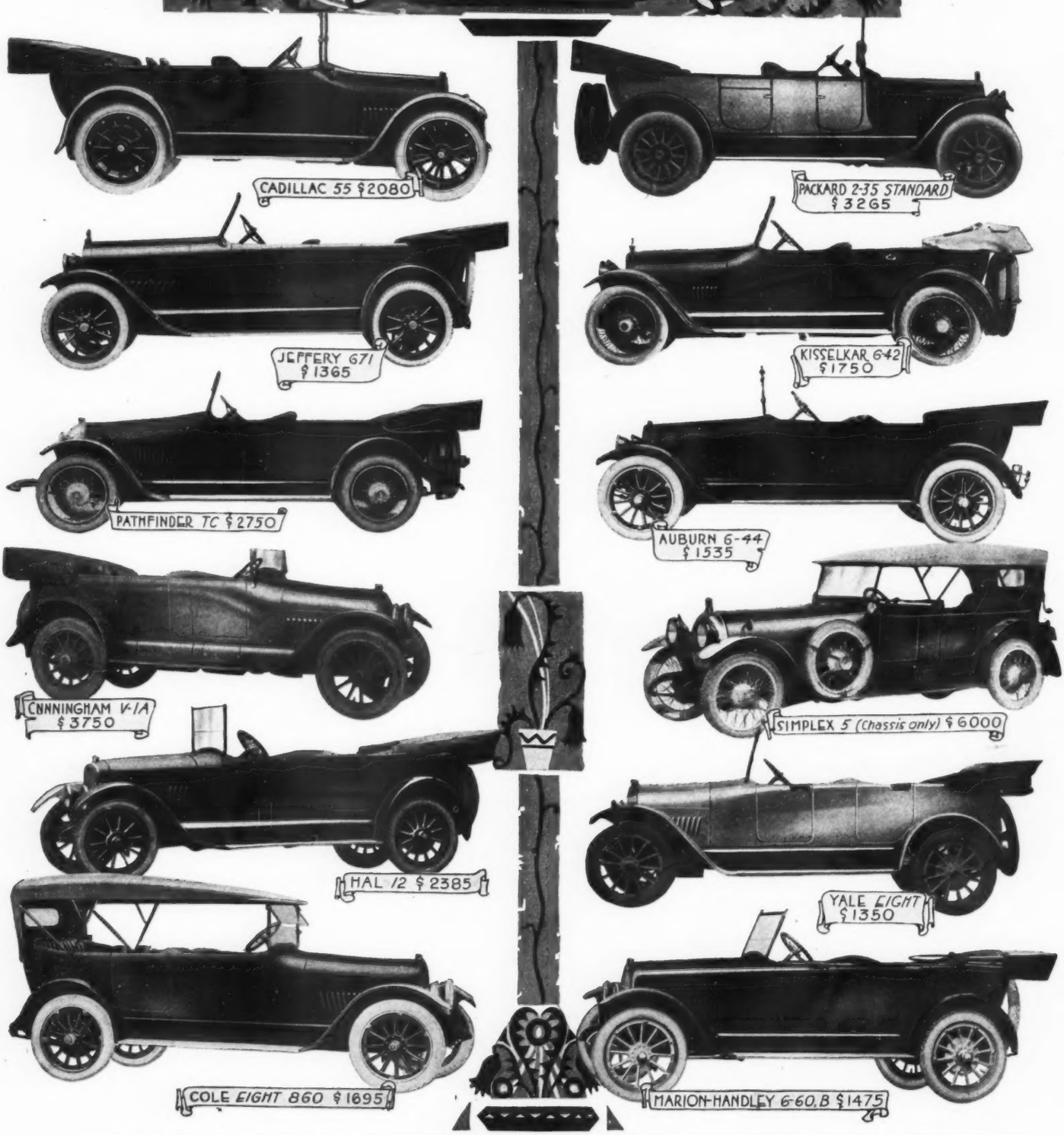
Name and Model	Price	Cyl.	H. P.	W. B.	Tires
Apperson Roadaplane, 6	$1750	6	29.40	130	34x4
Apperson Roadaplane, 8	2000	8	31.25	130	35x4½
Ben-Hur	1875	6	29.40	126	35x4½
Case, T-17	1190	4	21.03	120	34x4
Chalmers, 6-30	1350	6	25.35	122	34x4
Geneva	2500	6	38.40	139	34x4½
Haynes Six, 37	1685	6	29.40	127	35x4½

Name and Model	Price	Cyl.	H. P.	W. B.	Tires
Haynes Twelve, 41	$2185	12	36.30	127	34x4½
Hudson Super-Six, Phaeton	1650	6	29.40	125½	35x4½
Marmon, 34	3100	6	33.75	136	34x4½
Peerless Eight, 56	1890	8	33.80	125	35x4½
Reo, M	1250	6	30.46	126	34x4½
Ross Eight, C	1550	8	33.80	130	35x4½
Velie Biltwell Six, 27	1600	6	29.40	124	35x4½

Name and Model	Price	Cyl.	H. P.	W. B.	Tires
Daniels Eight, A	$2800	8	33.80	127	34x4½
Dorris, I-B-6	2475	6	38.40	128	36x4½
Jordan Sixty	1650	6	29.40	127	35x4½
King Eight, E	1585	8	28.80	120	34x4
Locomobile, M-7	5400	6	48.60	142	37x5
Locomobile, R-7	4600	6	43.35	139	37x5
Moon, 6-66	1650	6	29.40	125	35x4½

Name and Model	Price	Cyl.	H. P.	W. B.	Tires
Owen Magnetic, O-36	$3750	6	33.75	136	35x5
Paige, 6-46, Fairfield	1495	6	29.40	124	35x4½
Pierce-Arrow, 66	6000	6	60.00	147½	38x5½
Pierce-Arrow, 48	5000	6	48.60	142	37x5
Westcott, S-17	1690	6	29.40	125	35x4½
Winton Six, 48	3500	6	48.60	138	37x5
Winton Six, 33	2735	6	33.75	128	36x4½

Seven-Passenger Touring Cars



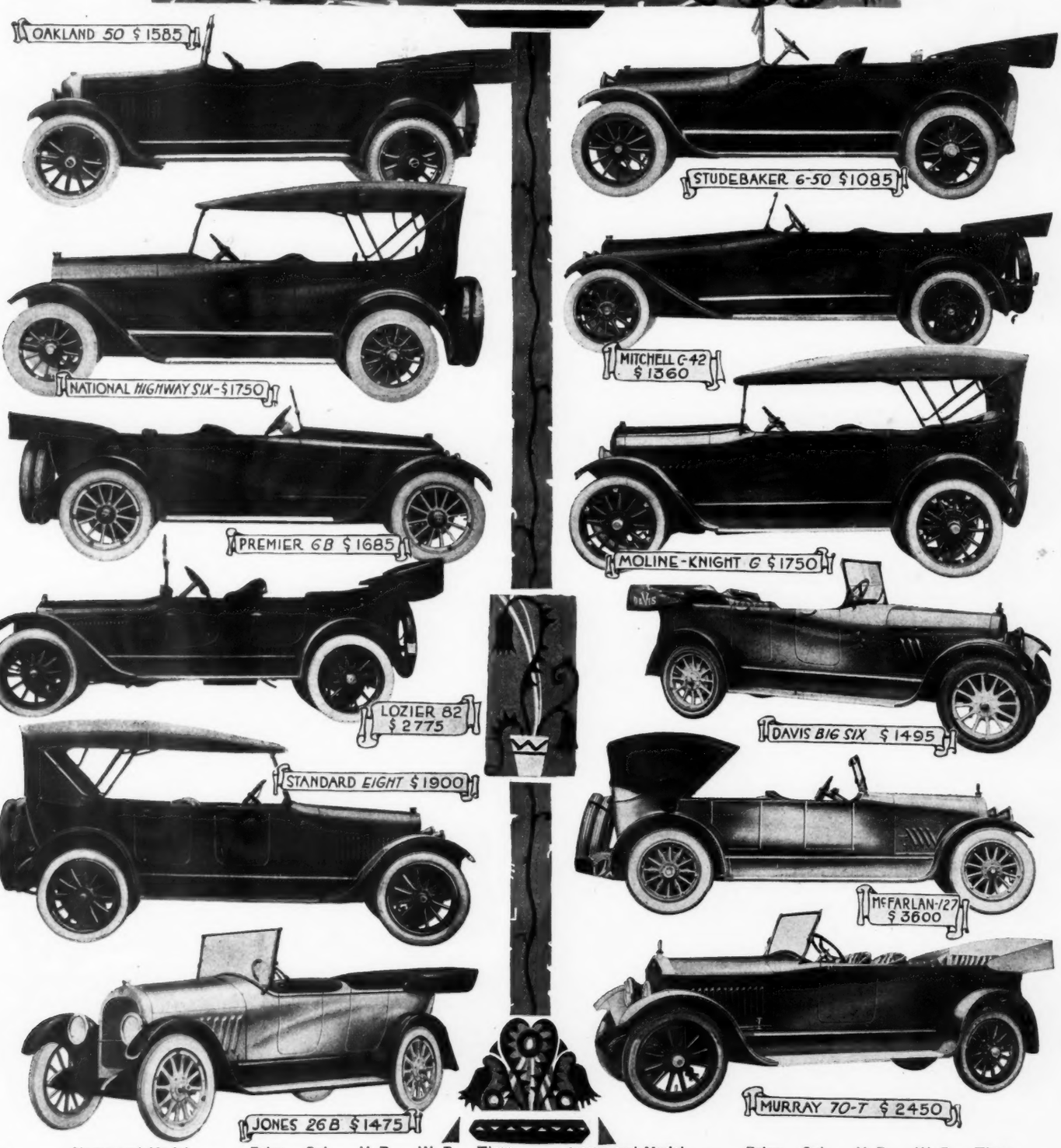
Name and Model	Price	Cyl.	H. P.	W. B.	Tires
Auburn, 6-44	$1535	6	29.40	131	35x4½
Cadillac, 55	2080	8	31.25	125	36x4½
Cole Eight, 860	1695	8	39.20	127	35x4½
Cunningham, V	3750	8	45.00	130	35x5
Hal, 12	2385	12	39.68	135	34x4½
KisselKar, 6-42	1850	6	31.54	128	34x4
Marion-Handley, 6-60	1475	6	29.40	125	35x4½
Marion-Handley, 6-40	1275	6	23.44	120	32x4

Name and Model	Price	Cyl.	H. P.	W. B.	Tires
*Packard, 2-35, Standard	$3500	12	43.20	135	35x5
Packard, 2-35, Salon	3500	12	43.20	135	35x5
Packard, 2-25, Standard	3050	12	43.20	126	35x5
Pathfinder, T C	2750	12	39.68	130	35x5
Simplex, 5 (Chassis only)	6000	6	45.94	143½	37x5
Yale Eight	1350	8	31.25	126	....

*Later price than shown in illustration.

SIDE GUIDE & GRIPPER

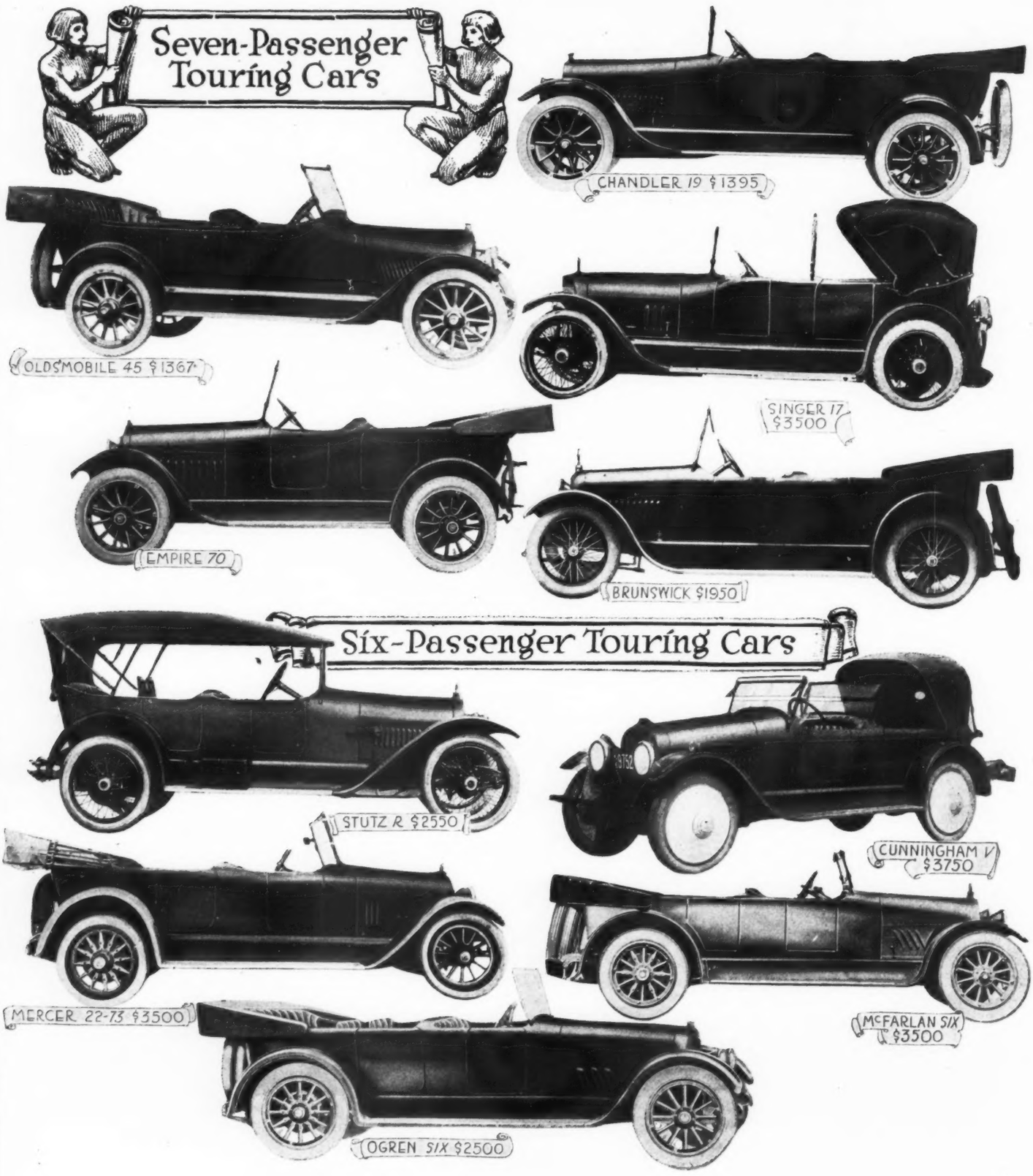
Seven-Passenger Touring Cars



Name and Model	Price	Cyl.	H. P.	W. B.	Tires
Davis, Big Six	$1495	6	29.40	124	34x4½
Davis, Light Six	1195	6	25.35	118	34x4
Jones Six, 26-B	1475	6	29.40	125	35x4½
Lozier, 82	2775	6	36.04	132	36x4½
*Mitchell, C-42	1460	6	29.40	127	34x4
*McFarlan Six, 127	3500	6	48.60	136	35x5
Moline-Knight, G	1750	4	25.60	122	35x4½
Murray, 70-T	2450	8	33.80	128	34x4½
National Highway Six	1750	6	29.40	128	34x4½
National Highway Twelve	$2150	12	39.68	128	34x4½
Oakland, 50	1585	8	39.20	127	34x4½
*Premier, 6B	1895	6	27.34	125½	35x4½
Standard Eight	1900	8	33.80	127	36x4½
*Studebaker, 6-50	1180	6	36.04	122	34x4
Studebaker, 4-40	940	4	24.03	112	34x4

*Later price than shown in illustration.

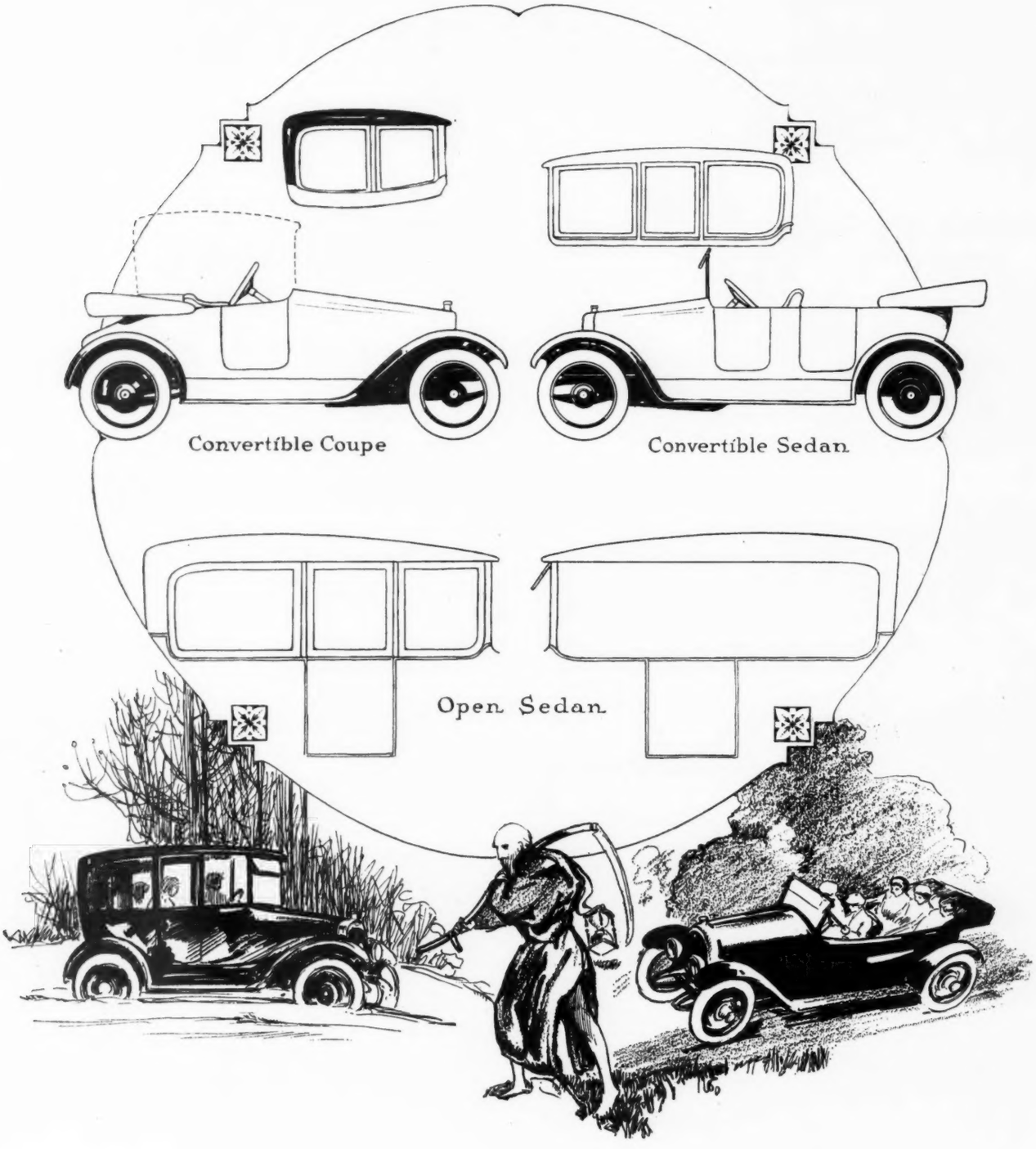
SIDE GLIDE & GRIPPER



Name and Model	Price	Cyl.	H. P.	W. B.	Tires
Brunswick	$1950	4	36.10	120	32x4½
Chandler, 17	1395	6	27.34	123	34x4
Cunningham, V	3750	8	45.00	130	35x5
Empire, 70	...	6	25.35	120	34x4
McFarlan Six, 127	3500	6	48.60	136	35x5

Name and Model	Price	Cyl.	H. P.	W. B.	Tires
Mercer, 22-73	$3500	4	22.50	132	34x4½
Ogren Six	2500	6	33.75	132	34x4½
Oldsmobile, 45	1367	8	26.45	120	34x4
Singer, 17	3500	6	38.40	136	35x5
Stutz, R	2550	4	36.10	130	34x4½

The Winter-Summer Cars

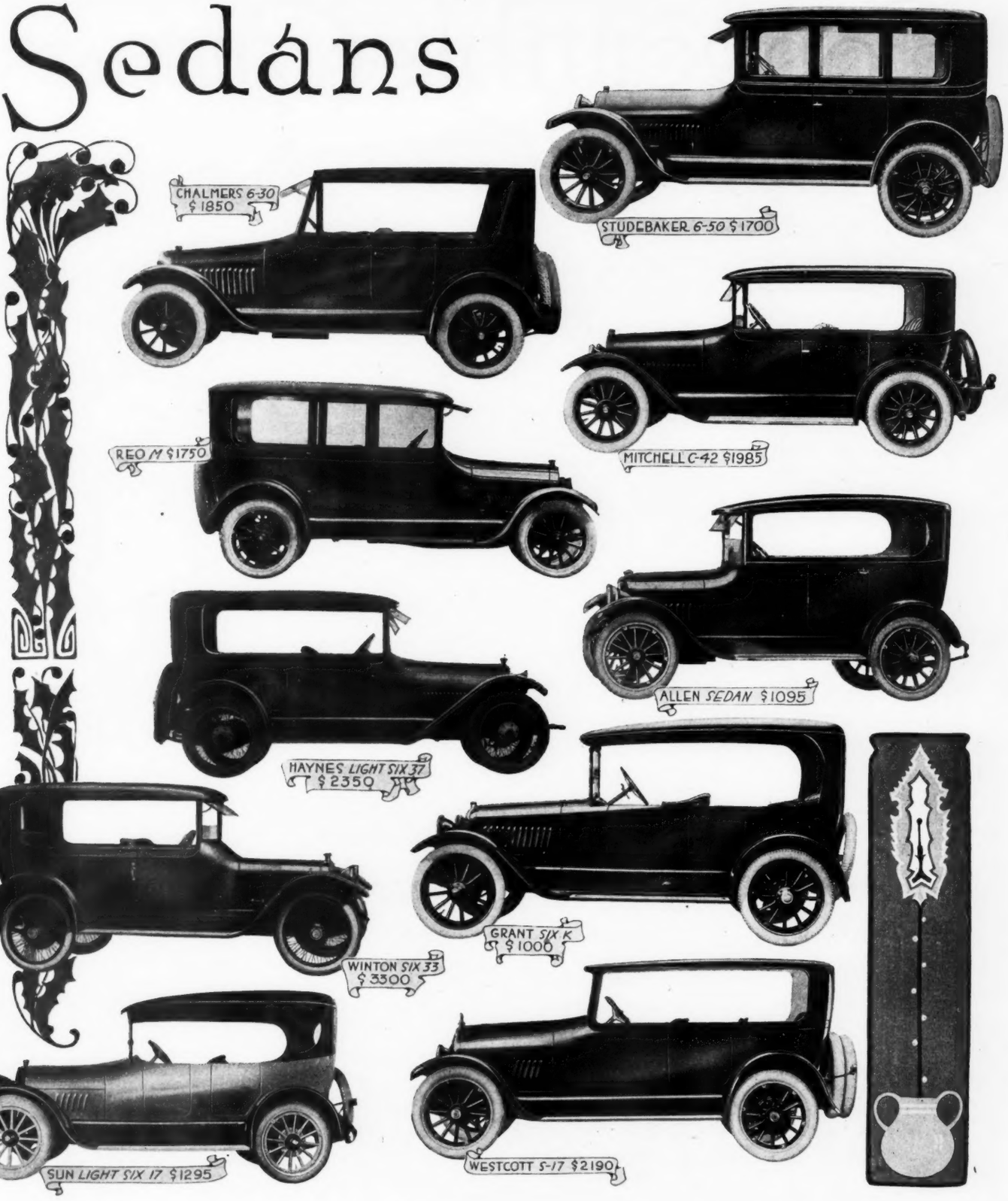


Open

Name and Model	Price	Cyl.	H. P.	W. B.	Tires
Cadillac, 55	$2675	8	31.25	125	36x4½
*Cole, 863, Toursedan	2295	8	39.20	127	35x4½
King Eight, EE	2150	8	28.80	120	34x4
Marmon, 34, Convertible Sedan	4100	6	33.75	136	35x5
Maxwell	985	4	21.03	103	30x3½
Moon, 6-66	2250	6	29.40	125	35x4½
Oakland, 34	$1020	6	18.99	112	32x4
Overland, 85-6	1325	6	25.35	116	33x4½
Overland, 85-4	1195	4	27.23	112	33x4½
Peerless Eight, 56	2750	8	33.80	125	35x4½
Velie, 28, Touring Sedan	1685	6	25.35	115	32x4

*Later price than shown in illustration.

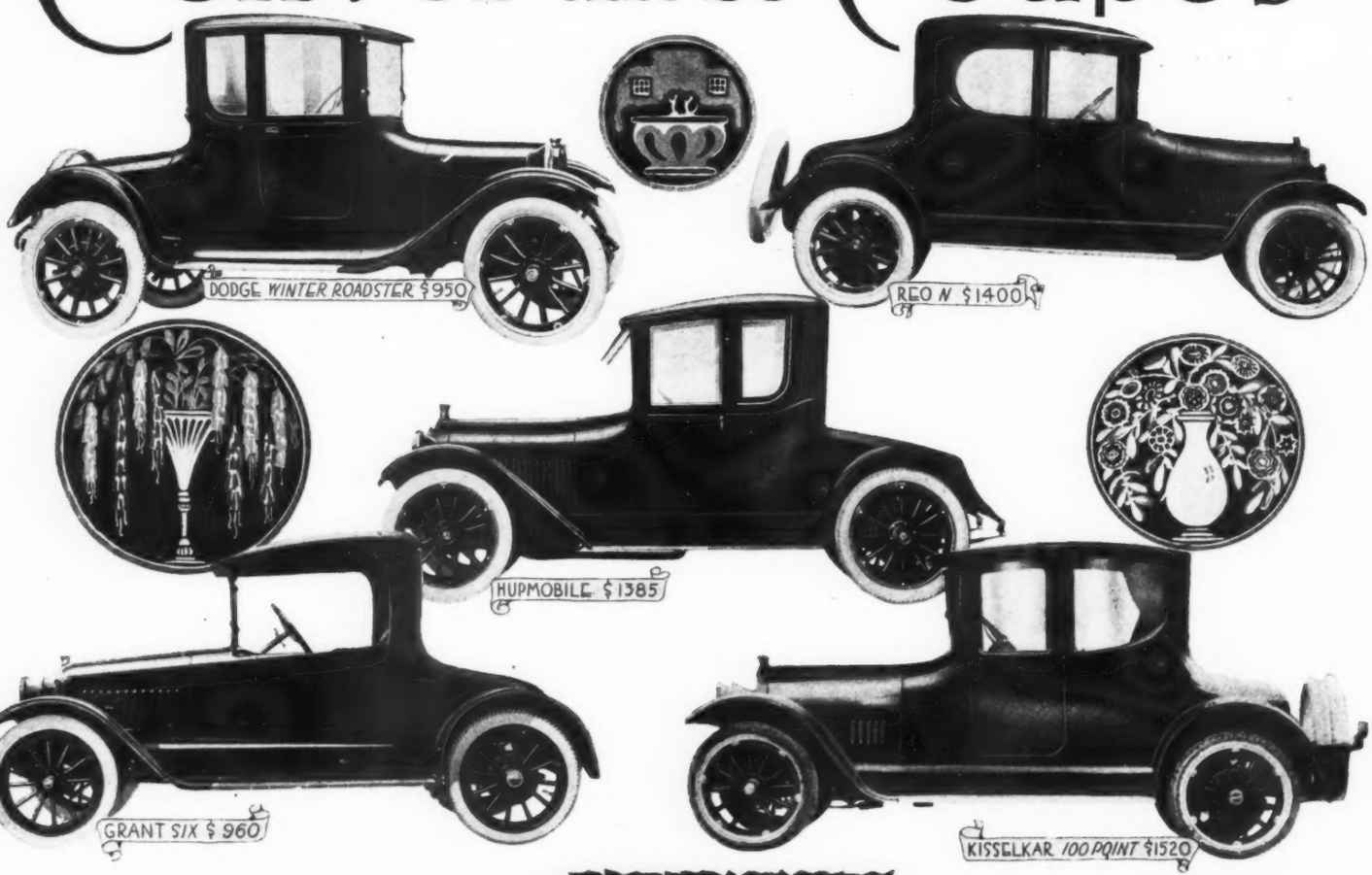
Sedans



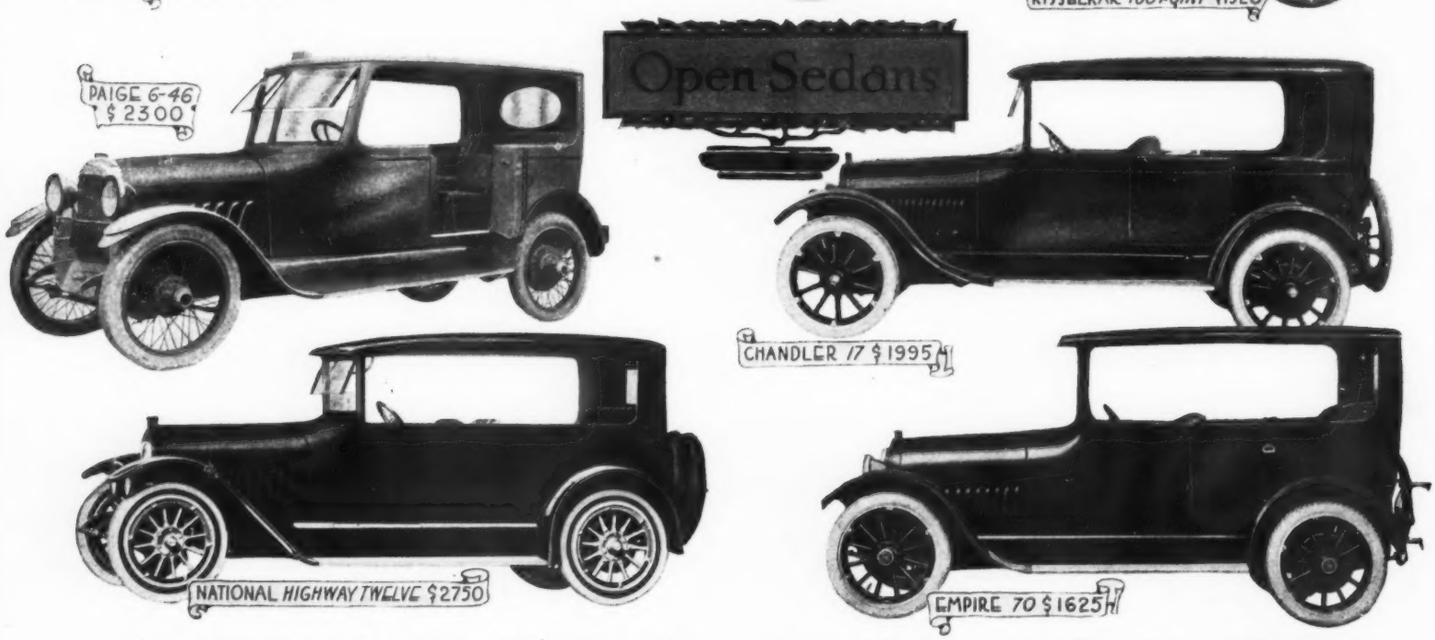
Name and Model	Price	Cyl.	H. P.	W. B.	Tires
Allen Sedan	$1195	4	22.50	112	33x4
Chalmers, 6-30	1850	6	25.35	122	34x4
Grant Six, K, Enclos'd T'r'g	1000	6	21.60	112	32x3½
Haynes Six, 37	2350	6	29.40	127	35x4½
*Mitchell, C-42	2085	6	29.40	127	34x4
Reo, M	1750	6	30.46	126	34x4½
Studeb'k'r, 6-50, T'r'g Sedan	1700	6	36.04	122	34x4
Sun, Light Six, 17	$1295	6	23.44	116	34x4
Westcott, S-17, T'r'g Sedan.	2190	6	29.40	125	35x4½
Westcott, S-17	2090	6	29.40	125	35x4½
Winton Six, 33	3300	6	33.75	128	36x4½
Winton Six, 48	3300	6	48.60	138	37x5

*Later price than shown in illustration.

Convertible Coupes



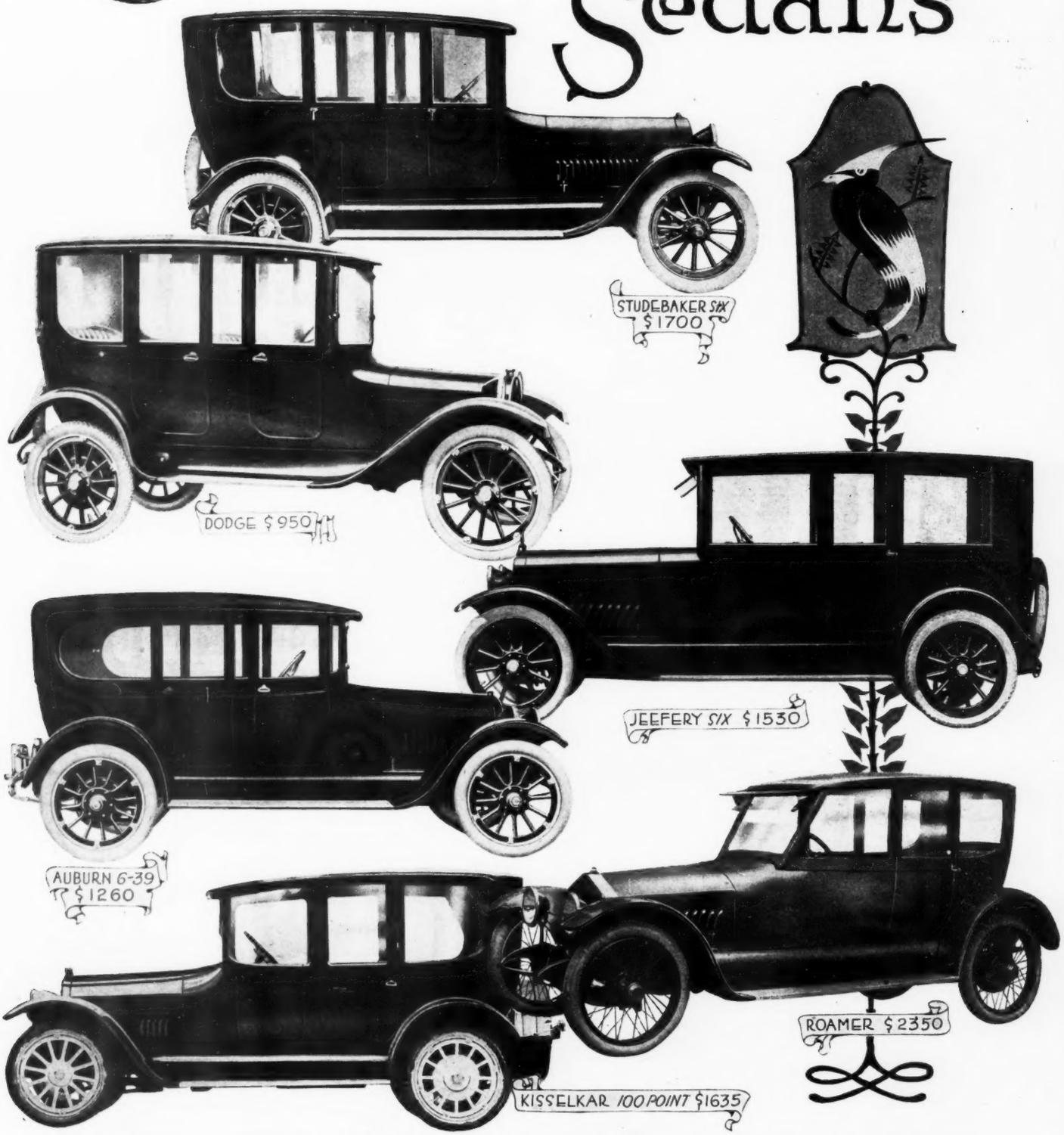
Open Sedans



Name and Model	Price	Cyl.	H. P.	W. B.	Tires
Dodge, Winter Roadster	$ 950	4	24.03	114	32x3½
Grant Six, Roadster Sedan	960	6	21.60	112	32x3½
Hupmobile, Year 'Round Roadster	1385	4	22.50	119	34x4
Kisselkar, 100 Point, All Year Coupe	1520	6	25.35	117	32x4
Reo, M, Convertible Coupe	1400	6	30.46	126	34x4½

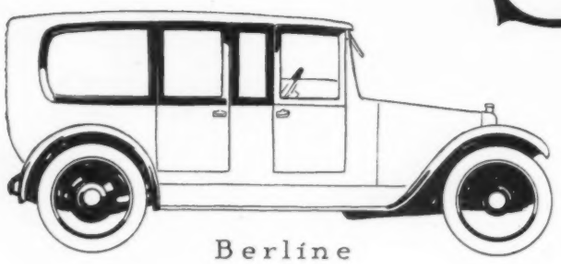
Name and Model	Price	Cyl.	H. P.	W. B.	Tires
Chandler, 17, Convertible Coupe	$1995	6	27.34	123	34x4
Empire, 70, Sedan	1625	6	25.35	120	34x4
National Twelve, Touring Sedan	2750	12	39.68	128	34x4½
National Six, Tour'g Sedan	2350	6	29.40	128	34x4½
Paige, 6-46	2300	6	29.40	124	35x4½

Convertible Sedans

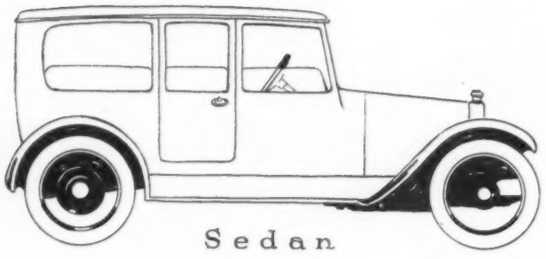


Name and Model	Price	Cyl.	H. P.	W. B.	Tires
Auburn, 6-39	$1260	6	23.44	120	34x4
Auburn, 6-44	1735	6	29.40	131	35x4½
Dodge, Winter Touring	950	4	24.03	114	32x3½
Jeffery Six	1530	6	29.40	125	34x4
Kissel, All-Year	$1635	6	25.35	117	32x4
Kissel, All-Year	1520	6	25.35	117	32x4
Roamer, Sedan	2350	6	23.44	124	34x4
Studebaker Six	1700	6	36.04	122	34x4

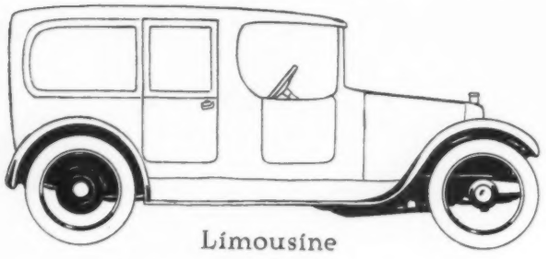
Closed Car Styles



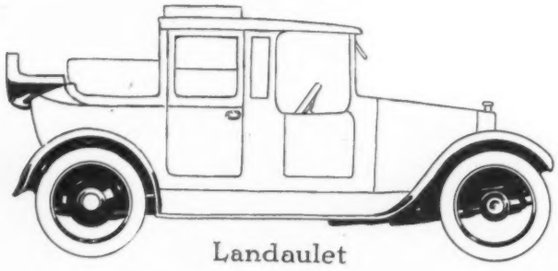
Berline



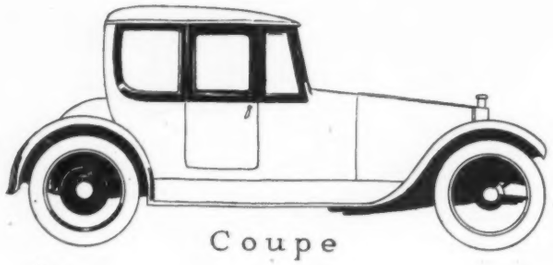
Sedan



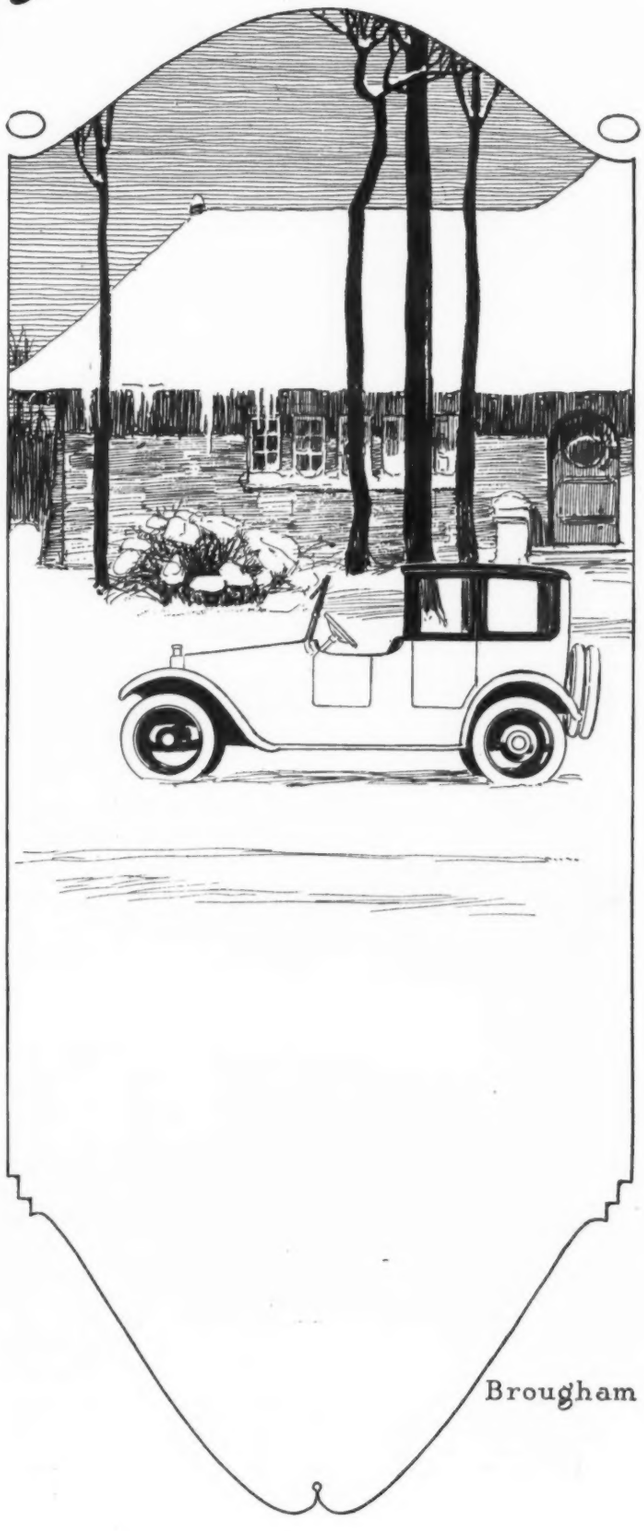
Limousine



Landaulet

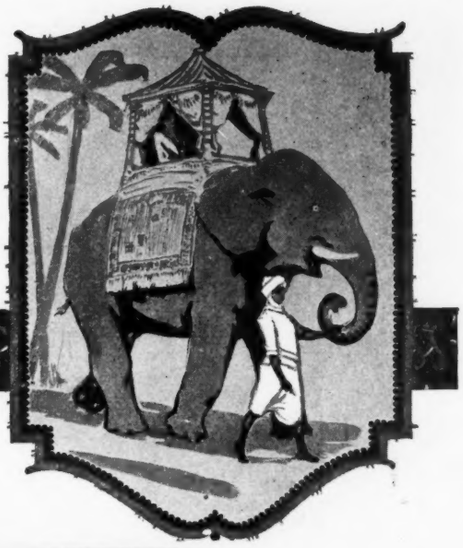


Coupe

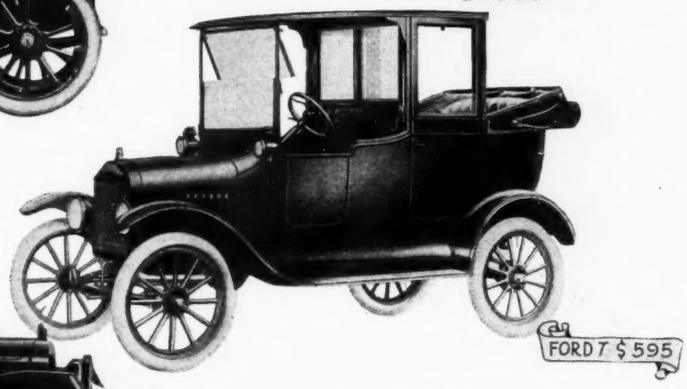


Brougham

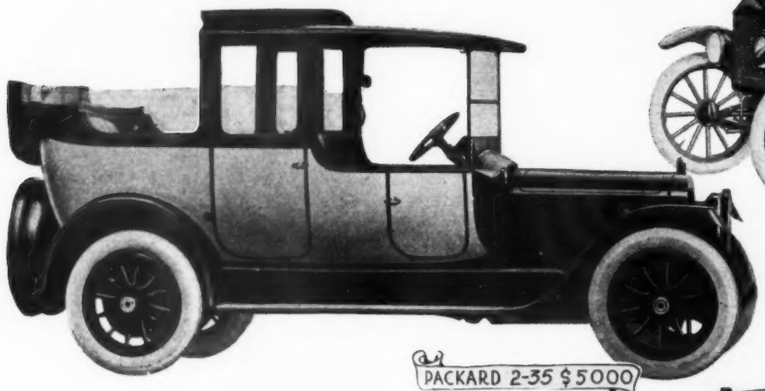
Berlines and Landaulets



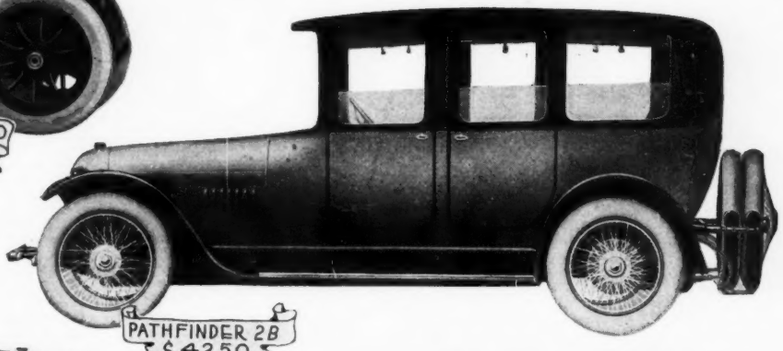
CADILLAC 55 $3750



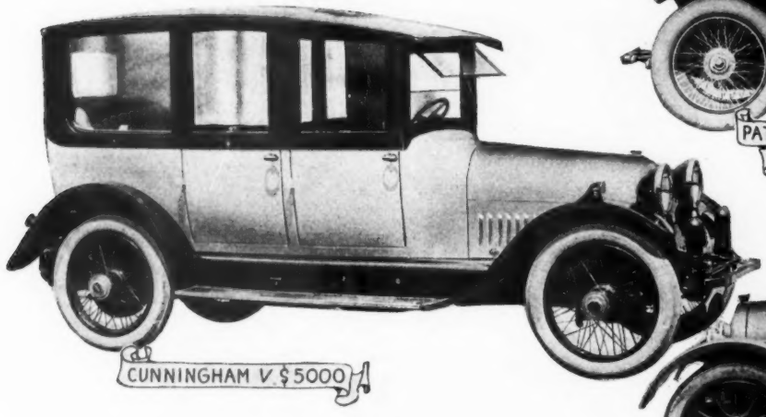
FORD T $595



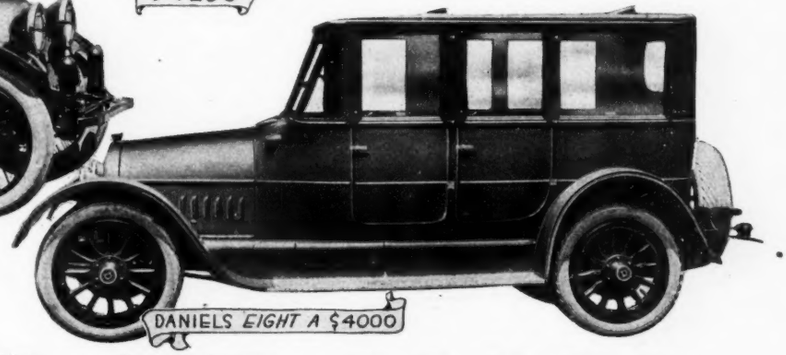
PACKARD 2-35 $5000



PATHFINDER 2B $4250



CUNNINGHAM V $5000

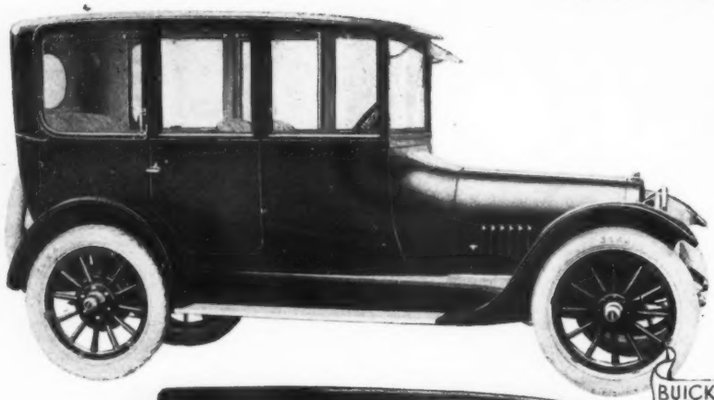


DANIELS EIGHT A $4000

Name and Model	Price	Cyl.	H. P.	W. B.	Tires
Cadillac, 55, Imperial	$3750	8	31.25	132	36x4½
Cadillac, 55	3750	8	31.25	132	36x4½
Cunningham, V, Landaulet	5250	8	45.00	130	35x5
Daniels Eight, A, Berlin Suburban	4000	8	33.80	127	34x4½
Ford, T, Town Car	595	4	22.50	100	30x3½

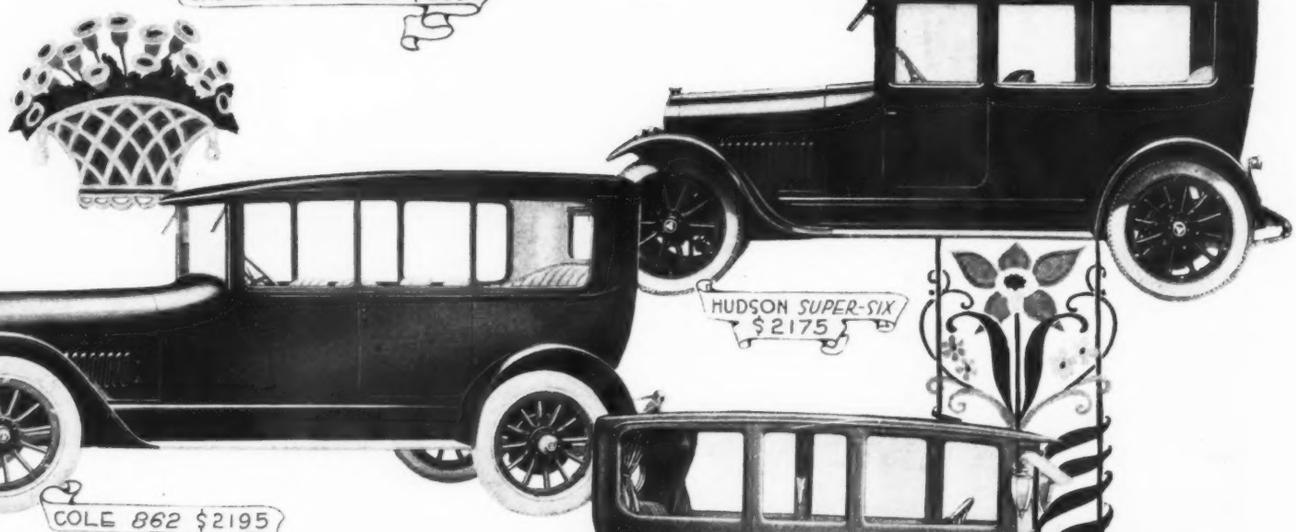
Name and Model	Price	Cyl.	H. P.	W. B.	Tires
Packard, 2-35, Landaulet	$5000	12	43.20	135	35x5
Packard, 2-35, Landaulet	5050	12	43.20	135	35x5
Packard, 2-35, Landaulet	4950	12	43.20	135	35x5
Packard, 2-25, Landaulet	4500	12	43.20	126	35x5
Pathfinder 2B, Berlin Limousine	4250	12	39.68	130	35x5

Sedans



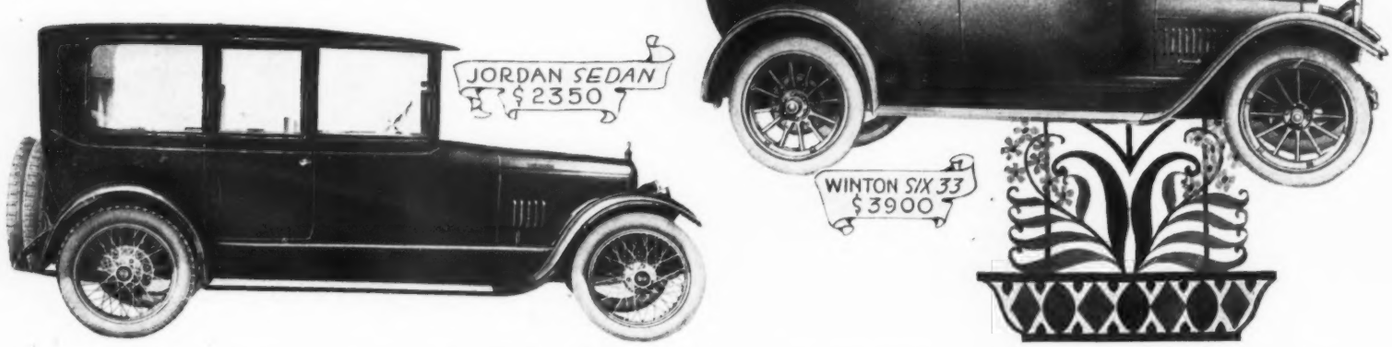
BUICK D-6-47 $1800

CADILLAC TYPE 55 $2950



HUDSON SUPER-SIX $2175

COLE 862 $2195

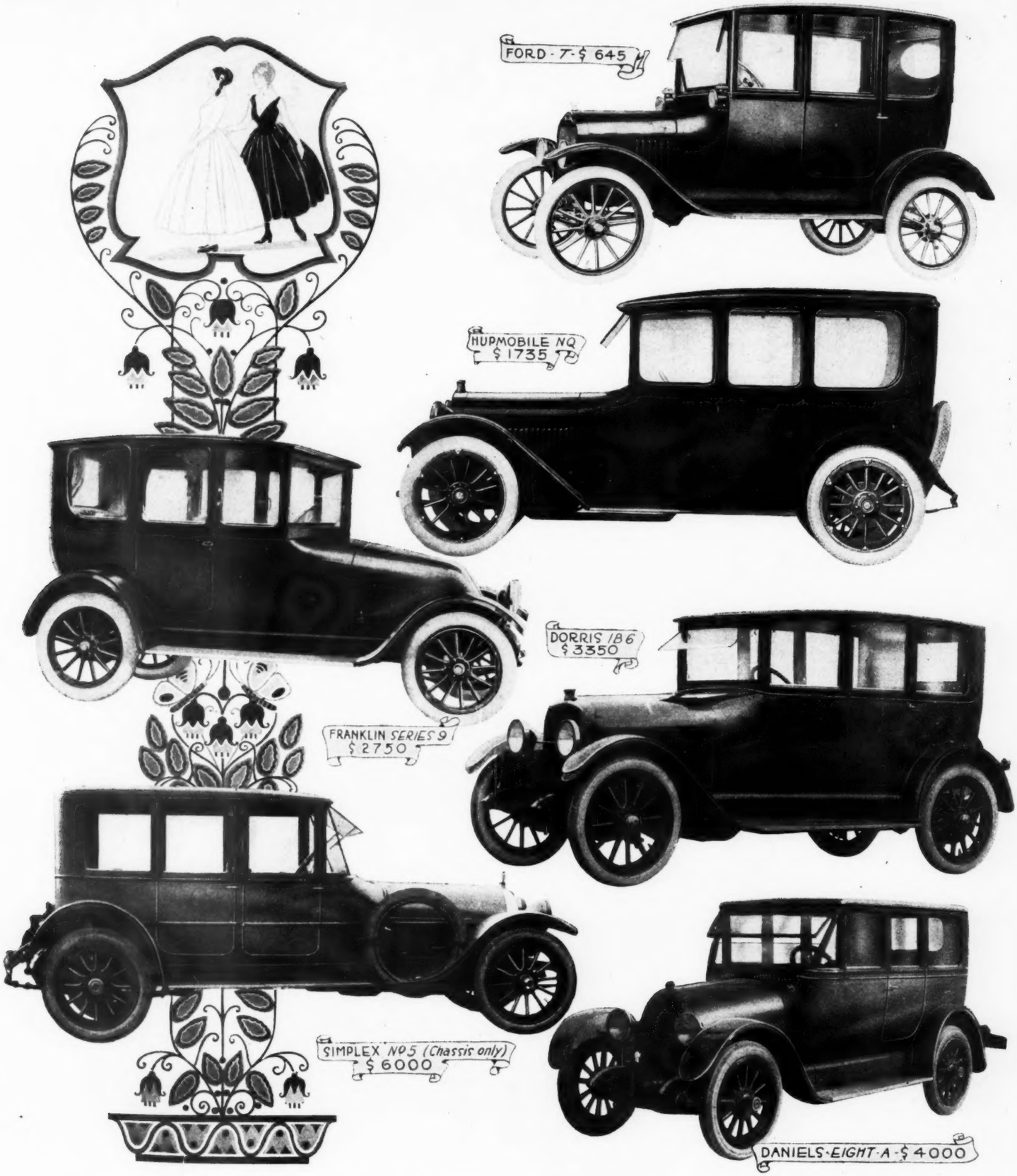


JORDAN SEDAN $2350

WINTON SIX 33 $3900

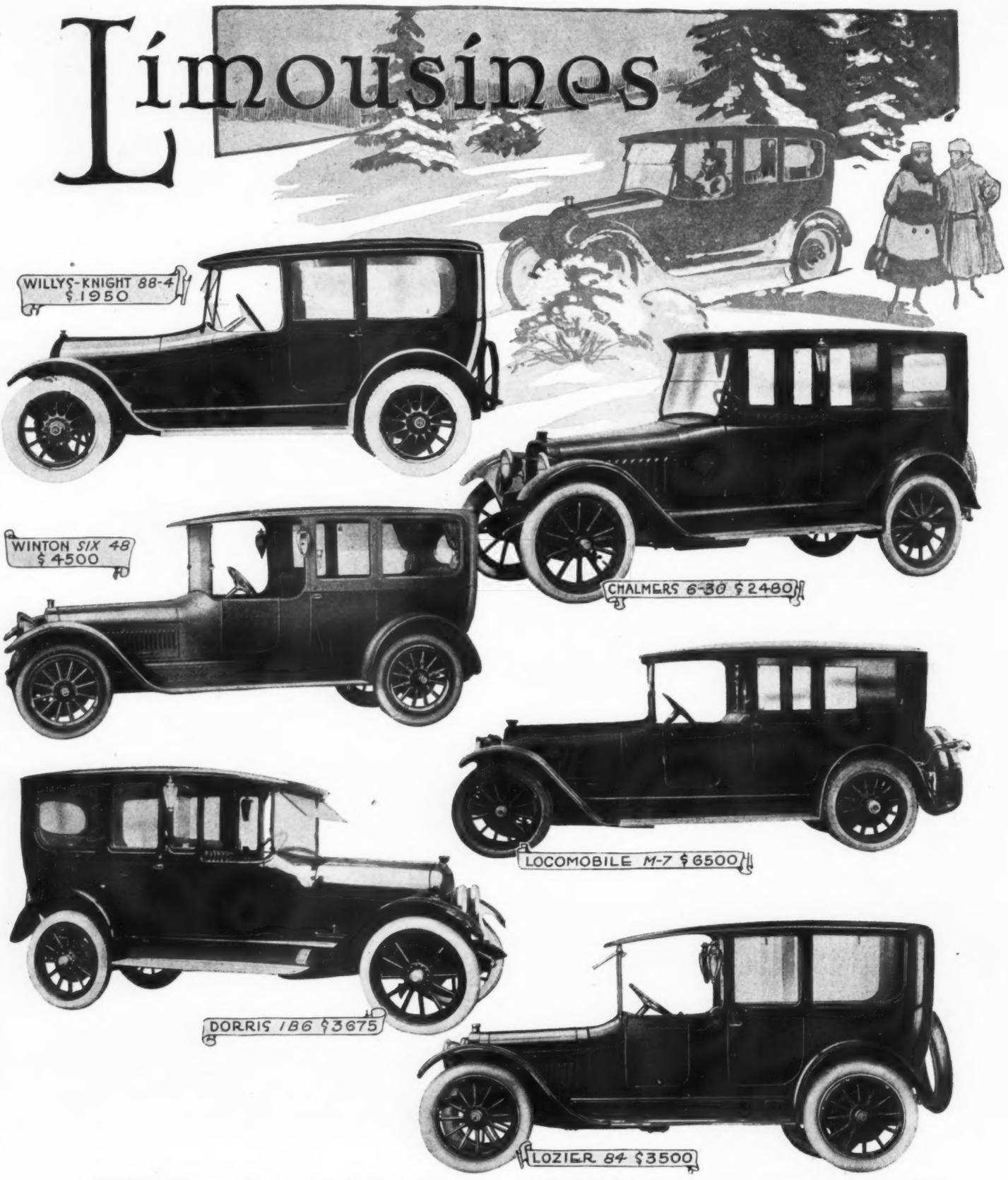
Name and Model	Price	Cyl.	H. P.	W. B.	Tires
*Buick, D-6-47	$1835	6	25.35	115	34x4
Cadillac, 55, Brougham	2950	8	31.25	125	36x4½
Cole, 862	2295	8	39.20	127	35x4½
Hudson Super-Six, Touring Sedan	2175	6	29.40	125½	35x4½
Jordan, Sedan	$2350	6	29.40	127	35x4½
Winton Six, 33	3900	6	33.75	128	36x4½
Winton Six, 48	4750	6	48.60	138	37x5

*Later price than shown in illustration.



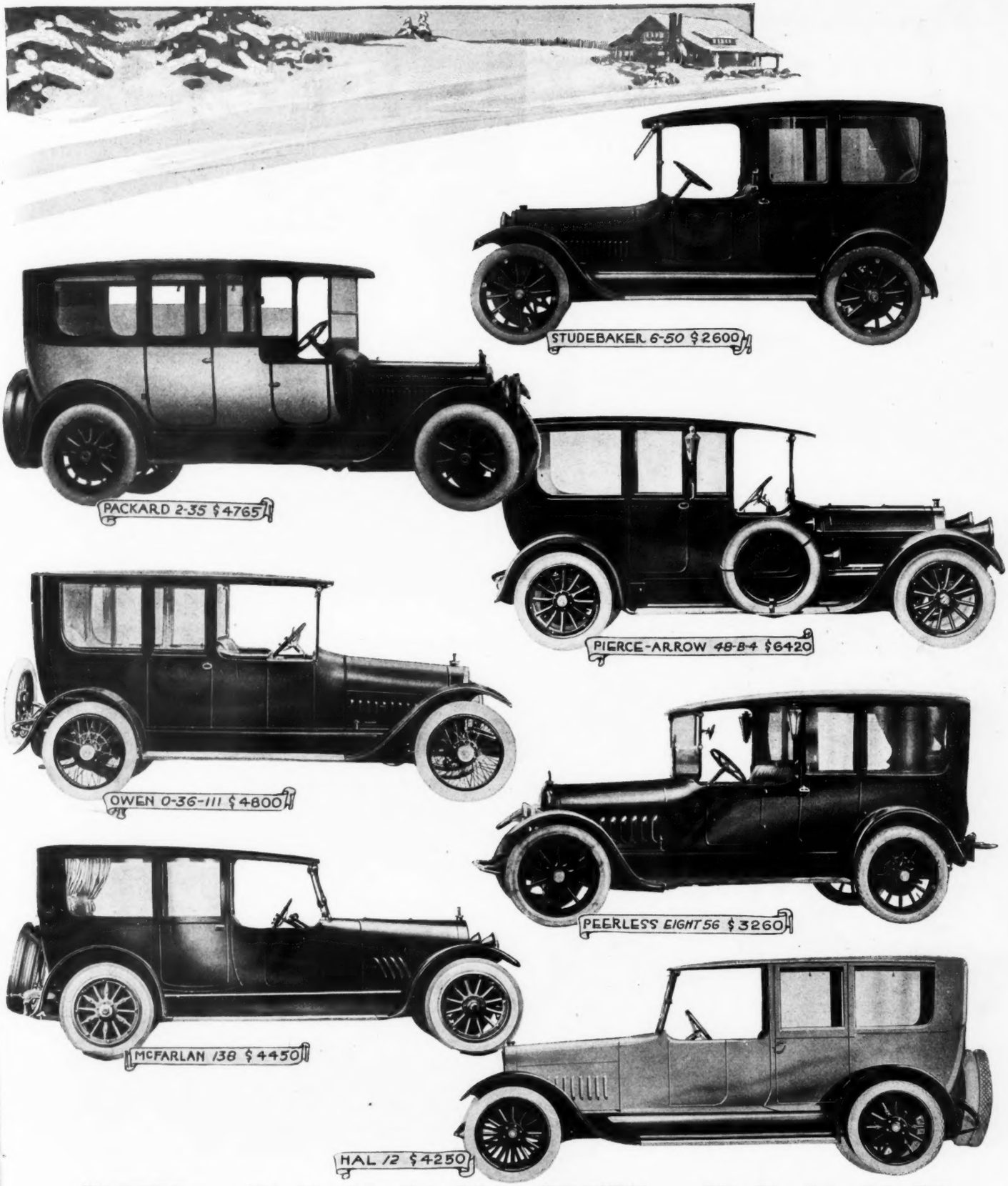
Name and Model	Price	Cyl.	H. P.	W. B.	Tires
Daniels Eight, A	$4000	8	33.80	127	34x4½
Dorris, 1B6	3350	6	38.40	128	36x4½
Ford, T	645	4	22.50	100	30x3½
Franklin, Series 9	2750	6	25.35	115	32x4
Hupmobile, NQ	$1735	4	22.50	119	35x4½
Reo	1750	6	30.46	126	34x4½
Simplex, No. 5 (Chassis only	6000	6	45.94	143½	37x5

Limousines



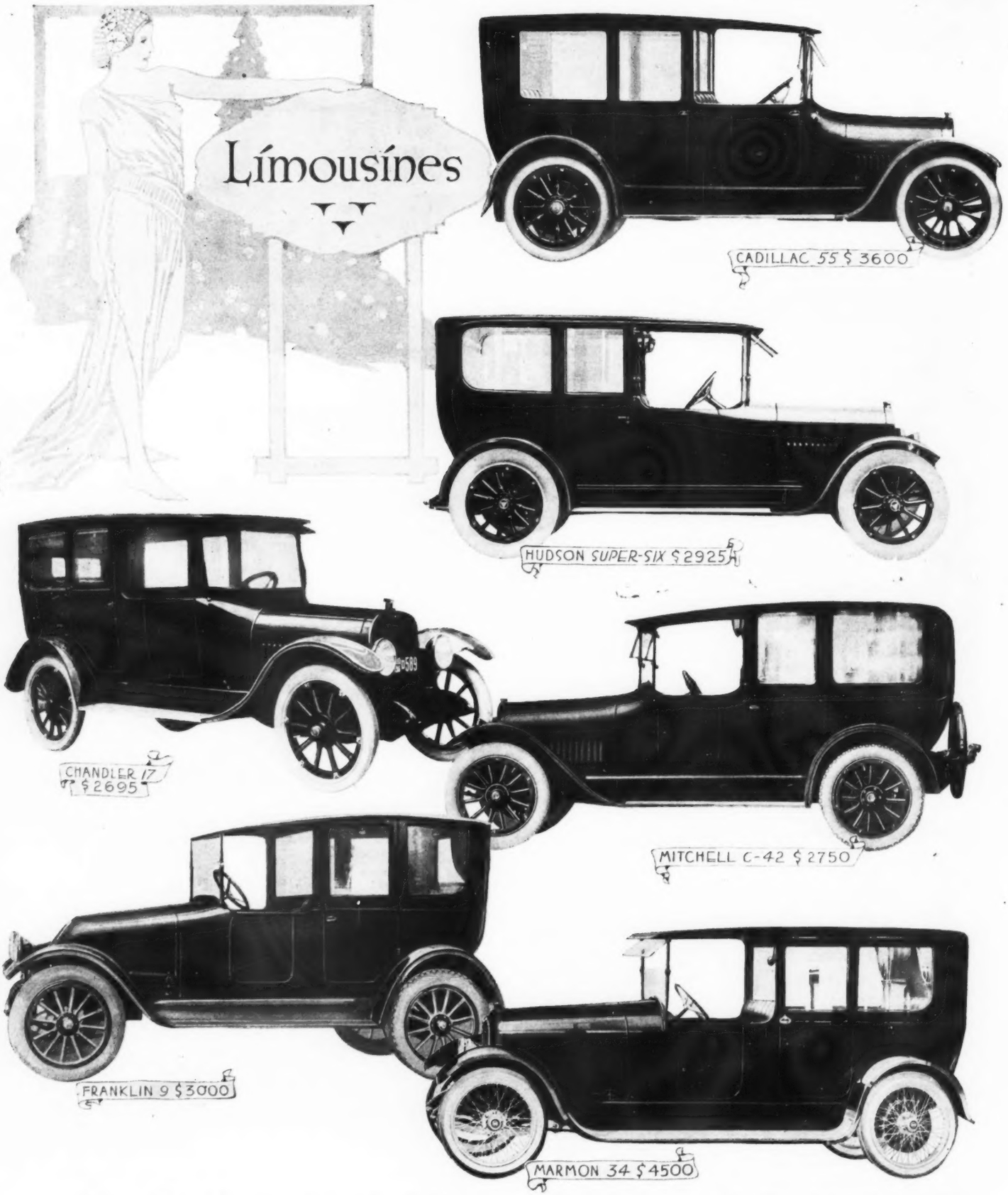
Name and Model	Price	Cyl.	H. P.	W. B.	Tires
*Chalmers, 6-30	$2550	6	25.35	122	34x4
Dorris, 1B6	3675	6	38.40	128	36x4½
Locomobile, M-7	6500	6	48.60	142	37x5
Locomobile, R-7	5600	6	43.35	139	37x5
Lozier, 84, Sedan Limousine	3500	..	....	...	....
Willys-Knight, 88-4	$1950	4	27.23	121	34x4½
Winton Six, 48	4500	6	43.35	138	37x5
Winton Six, 33	3650	6	33.75	128	36x4½

*Later price than shown in illustration.



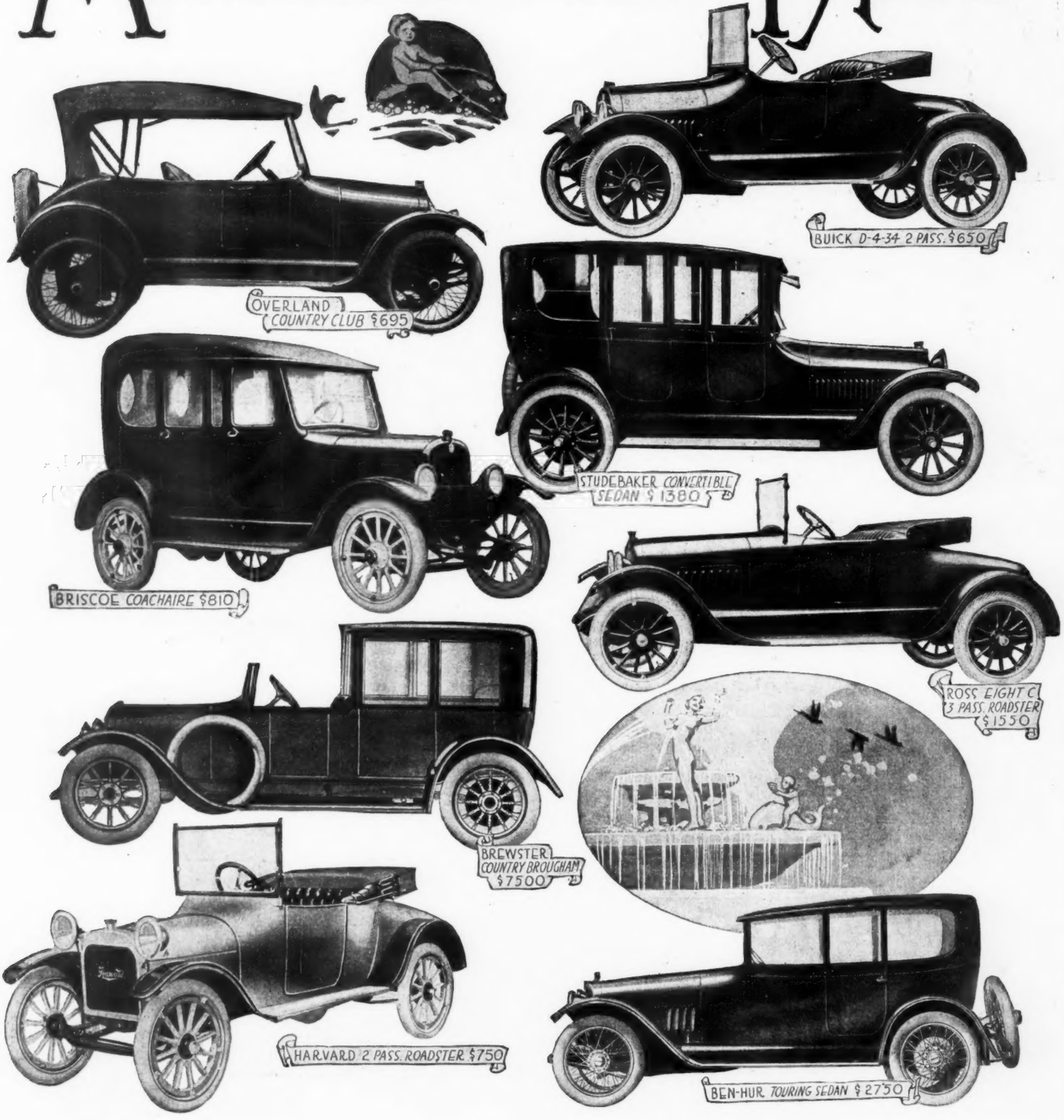
Name and Model	Price	Cyl.	H. P.	W. B.	Tires
Hal 12	$4250	12	39.68	135	34x4½
*McFarlan, 138	4750	6	48.60	136	35x5
Owen Magnetic, O-36	4800	6	33.75	136	35x5
Owen Magnetic, M-25	4200	6	29.40	125	34x4½
Peerless Eight	3260	8	33.80	125	35x4½
Pierce-Arrow 48-B-4 Suburban	6420	6	48.60	142	37x5
Pierce-Arrow, 66, Suburban.	7420	6	60.00	147½	38x5½
*Packard, 2-35	$5000	12	43.20	135	35x5
Packard, 2-35	4950	12	43.20	135	35x5
Packard, Imperial	5150	12	43.20	135	35x5
Packard, 2-35	4900	12	43.20	135	35x5
Packard, 2-25	4450	12	43.20	126	35x5
Studebaker 6-50	2600	6	36.04	122	34x4

*Later price than shown in illustration.



Name and Model	Price	Cyl.	H. P.	W. B.	Tires
Cadillac, 55	$3600	8	31.25	132	36x4½
Chandler, 17	2695	6	27.34	123	34x4
Franklin, 9	3000	6	25.35	115	32x4
Hudson Super-Six	$2925	6	29.40	125½	35x4½
Marmon, 34	4500	6	33.75	136	35x5
Mitchell, C-42	2750	6	29.40	127	34x4

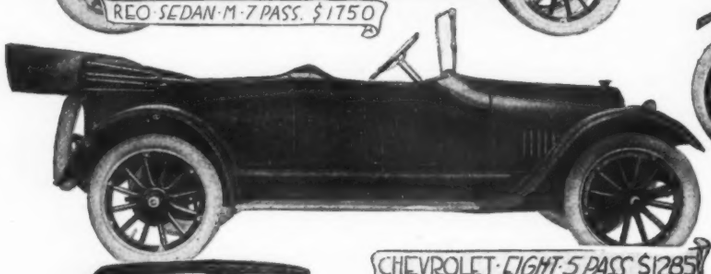
Miscellaneous Types

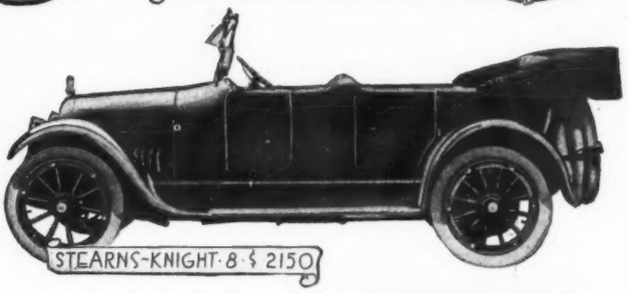

OVERLAND COUNTRY CLUB $695
BUICK D-4-34 2 PASS. $650
STUDEBAKER CONVERTIBLE SEDAN $1380
BRISCOE COACHAIRE $810
ROSS EIGHT C 3 PASS. ROADSTER $1550
BREWSTER COUNTRY BROUGHAM $7500
HARVARD 2 PASS. ROADSTER $750
BEN-HUR TOURING SEDAN $2750

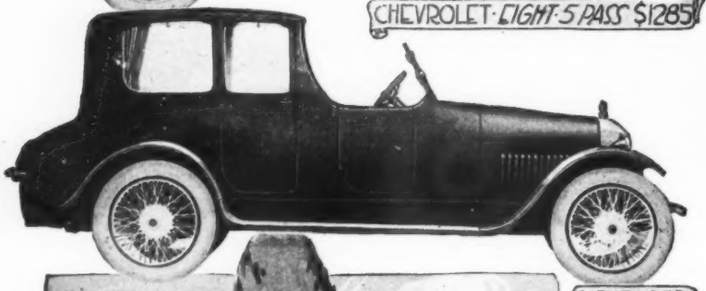
Name and Model	Price	Cyl.	H.P.	W.B.	Tires
Ben-Hur, Touring Sedan	$2750	6	29.40	126	35x4½
Brewster, Country Bro'gh'm	7500	4	25.60	125	34x4½
Briscoe Coachaire	810	4	33.16	105	30x3½
*Buick, D-4-34, 2-Passenger.	660	4	18.23	106	31x4
Harvard, 2-Passenger	750	4	14.40	100	28x3
Overland, Country Club	695	4	18.23	104	31x4
Studebaker, Convert. Sedan.	$1380	6	36.04	122	34x4
Studebaker, Convert. Sedan.	1140	4	24.03	112	34x4
Ross Eight, C, 3-Passenger.	1150	8	33.80	130	35x4½

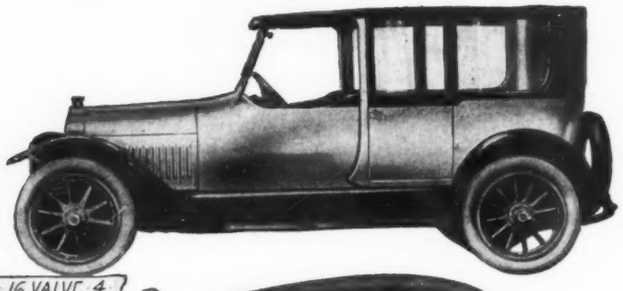
*Later price than shown in illustration.

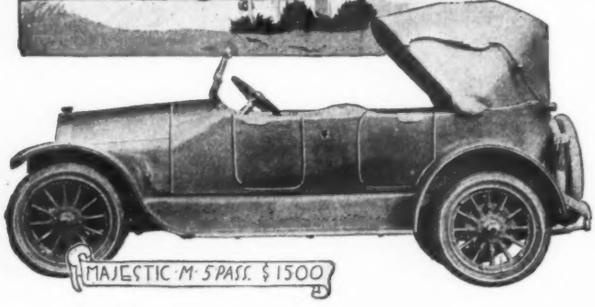
Miscellaneous Body Types

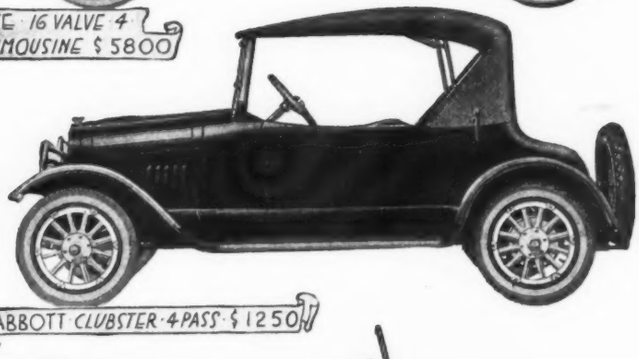


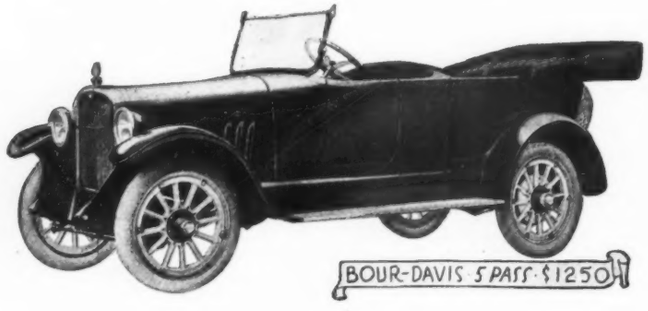


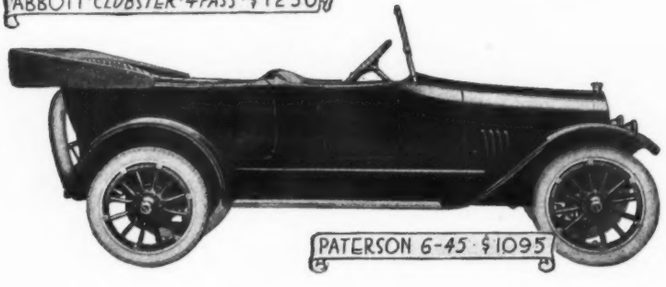








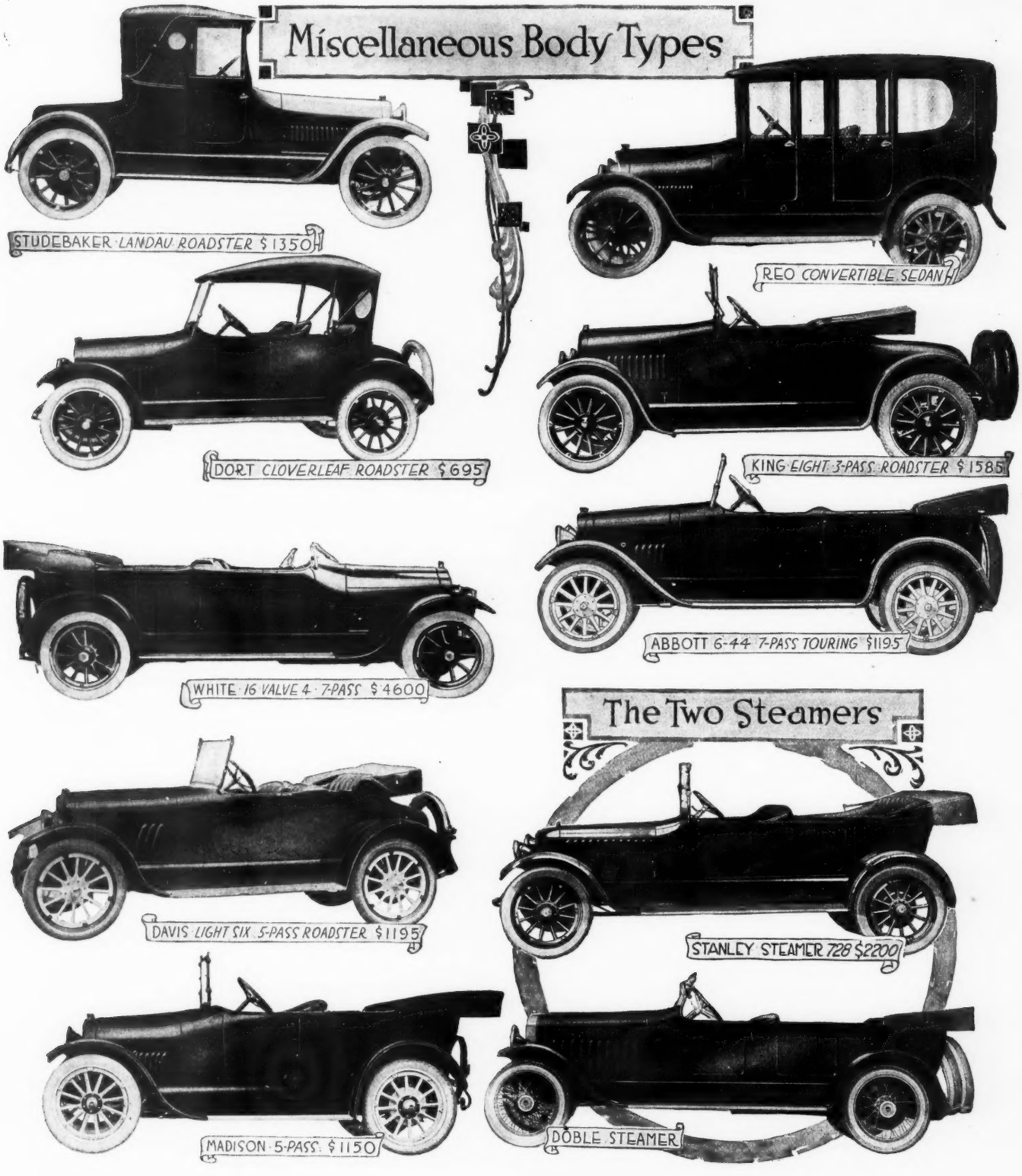




Name and Model	Price	Cyl.	H.P.	W.B.	Tires
Reo Sedan, M, 7-pass.	$1750	6	30.46	126	34x4½
Chevrolet Eight, 5-pass.	1100	8	36.45	120	34x4
Pathfinder Town Car, 7-pass.	....	12	39.68	135	35x5
Majestic, M, 5-pass.	1500	8	28.80	125	32x4
Bour-Davis, 5 pass.	1250	6	25.35	118	32x4

Name and Model	Price	Cyl.	H.P.	W.B.	Tires
Oldsmobile, 45, Club roadster	$1295	8	26.45	120	33x4
Stearns-Knight, 8	2150	8	33.80	123	35x4½
White, 16 Valve 4, limousine	5800	4	28.90	137½	37x5
Abbott Clubster, 4-pass.	1250	6	25.35	122	32x4
Paterson, 6-45	1095	6	25.35	117	32x4

Miscellaneous Body Types


STUDEBAKER LANDAU ROADSTER $1350
REO CONVERTIBLE SEDAN
DORT CLOVERLEAF ROADSTER $695
KING EIGHT 3-PASS ROADSTER $1585
WHITE 16 VALVE 4 7-PASS $4600
ABBOTT 6-44 7-PASS TOURING $1195
The Two Steamers
DAVIS LIGHT SIX 5-PASS ROADSTER $1195
STANLEY STEAMER 728 $2200
MADISON 5-PASS $1150
DOBLE STEAMER

Name and Model	Price	Cyl.	H.P.	W.B.	Tires
Studebaker, Landau roadster	$1350	6	36.04	122	34x4
Dort, Cloverleaf roadster	695	4	16.90	105	30x3½
White, 16 Valve 4, 7-pass.	4600	4	28.90	137½	37x5
Davis Light Six, 5-pass. roadster	1195	6	25.35	118	34x4

Name and Model	Price	Cyl.	H.P.	W.B.	Tires
Madison, 5-pass.	$1150	6	23.44	115	34x4
Reo, Convertible Sedan		6	30.46	126	34x4½
King Eight, 3-pass. roadster	1585	8	28.80	120	34x4
Abbott, 6-44, 7-pass. touring	1195	6	25.35	122	32x4
Stanley Steamer, 728	1975	..	....	...	....
Doble Steamer, 5-pass.	....	..	....	...	....

The Automobiles of 1917

Brief Descriptions of New Models and an Outline of Engineering Changes and Developments During 1916—New Cars Whose Details Were Received Too Late for Inclusion in the Specification Tables

Section 1, Four-Cylinder Cars. Section 2, Page 71, Six-Cylinder Cars. Section 3, Page 79, Eight and Twelve-Cylinder Cars

Section 1—Four-Cylinder Cars

WHEN making the classification of American passenger automobiles there are two cars which will not fit into the scheme, these being the Stanley and Doble steam cars. Electric cars are not considered in this issue, but will be reviewed at a later date.

Steam Cars

The Stanley is one of the oldest makes in America, and is practically the only steam car now being built on a manufacturing scale. The Stanley of to-day is a vastly better machine than it was some years ago. Always very powerful and reliable, it can now run over 200 miles on one filling of water, and it burns kerosene instead of gasoline. The control is entirely automatic. Reducing the system to its simplest or diagrammatic form, there are two pumps, one for water and one for kerosene, always working. When the water level in the boiler reaches the proper height a by-pass is opened which causes the pump to merely circulate water and to send no more to the boiler. This by-pass is operated by a long tube, the expansion of which shuts the by-pass. This tube is connected to a certain point on the boiler. When it is filled with steam it is hot, and so keeps the by-pass closed. As soon as water reaches the tube the latter cools off and the by-pass opens. The fire is controlled by the steam pressure. When this reaches its limit it presses on a diaphragm and opens a fuel by-pass that causes the fuel pump to send its charge back to the tank instead of to the burner. These automatic devices are very simple and very strong.

Under the boiler there is a small light burning all the time, this being fed from a small tank of gasoline under air-pressure. A gallon of gas will run this pilot light for about 3 days. The purpose of the pilot light is to fire the kerosene burner every time the automatic control turns on the supply. Driving consists merely of opening and shutting the throttle, nothing else having to be touched for all ordinary driving. The engine is built up in unit with the rear axle.—*Stanley Motor Carriage Corp., Nowton, Mass.*

The Doble is a new car about to come on the market. It has a new boiler and fire system. Beneath the boiler there is a fire box with a sort of spark plug at the center. This instead of giving a spark, heats a coil of wire to incandescence. An electric blower supplies air and fuel mixed through a kind of carbureter and the plug ignites this, the current being switched off as soon as the fire is burning. Steam pressure operates the switches for the blower and plug, so that when the pressure reaches its limit the fire is shut off and when the pressure drops it is turned on again automatically. A very large condenser is employed, giving a big range on one filling of water. The engine has many distinctive points. It is mounted on the rear axle like the Stanley, but the valve gear is not the same.—*General Engineering Co., Detroit.*

Below commences the classified list of four cylinder cars. Where there are several cars of the same make, but with different numbers of cylinders a note to that effect will be found, giving the page where the other design is dealt with.

Allen

Changes in the Allen car have been very few and of very minute detail. One is the alteration of the angle of the Bendix pinion and in the method of rounding these off to avoid chipping the flywheel gears. A slight change in crankshaft manufacturing methods is giving better results, the change being to fit the bearing more closely than formerly, with particular attention to hand reaming. The use of anti-squeak material has been increased between all the sheet metal parts and the body. Heretofore this material was inserted between the body and the frame, but now it is placed in other parts, particularly the sew-up points of the mudguards to running board and front and rear fender aprons. It is also placed between the front fenders and the frame. A slight change is being made in the brake levers so that the required pedal pressure is somewhat less and the frequency of brake adjustments reduced. Another detail change is in the increase of stiffness of the front springs and the softening of the rear, this change giving better riding qualities both in the front and rear end of the car.—*Allen Motor Co., Fostoria, Ohio.*

Biddle

Only body alterations have been made to this high speed, high grade four. The alterations are typical of modern trends in bodywork, in that they are a little away from 1916 practice. The double cowl has been abandoned, outside door handles are being used and several other things which were cut off by the streamline extremists. The new Biddle bodies are a possible indication of what may happen generally to the existing most popular type of coachwork.—*Biddle Motor Car Co., Philadelphia, Pa.*

Brewster

There have been no changes in this high priced Knight engine car. It was a new design last year and is typically European in every way. It is one of the few cars with the gearbox located at the front end of the torque tube and is of very massive construction. The frame is heavily stiffened and is intended to be absolutely rigid in every direction. The brakes are very large and the whole chassis is designed without regard to cost. Long service without adjustment

is one of the principal claims made.—*Brewster & Co., Long Island City, N. Y.*

Briscoe

During the year Briscoe has added a new car fitted with a four-cylinder engine with detachable head. In this engine the cylinder block unit includes the exhaust manifold and also the upper half of the crankcase. The detachable head gives access to the valve chambers and cumbustion space and the left part of the top is taken up by a large water outlet connection for the thermo-syphon system. The lower half of the crankcase is made up of a pressed steel pan. This new Briscoe carries its gearbox in unit with the rear axle. Another unusual feature is the drive of the generator which is from the rear end of the camshaft through a gear connection. The generator is located close to the flywheel on the valve side of the engine with the gearing housed in the extension of the right rear supporting arm of the engine. The ignition distributer is mounted on the front end of the generator unit and there is a bevel gear driving connection between its vertical shaft and the horizontal armature shaft. Another unusual feature is in the clutch which is an inverted cone. Instead of being pulled out or backward to disengage it is pushed forward toward the engine. This enables the assembly to be simplified to the extent of using a simple universal coupling acting directly against the center of the cone, as a throw-out mechanism. This is carried by forged arms extending out from either side of the engine support and the pedal shaft is carried transversely by these arms. Full elliptic springs are used both front and rear with the rear pair underslung. The frame has a straight taper from the rear to the front and the narrow high radiator is set directly on the side members.—*Briscoe Motor Corp., Jackson, Mich.*

Buick

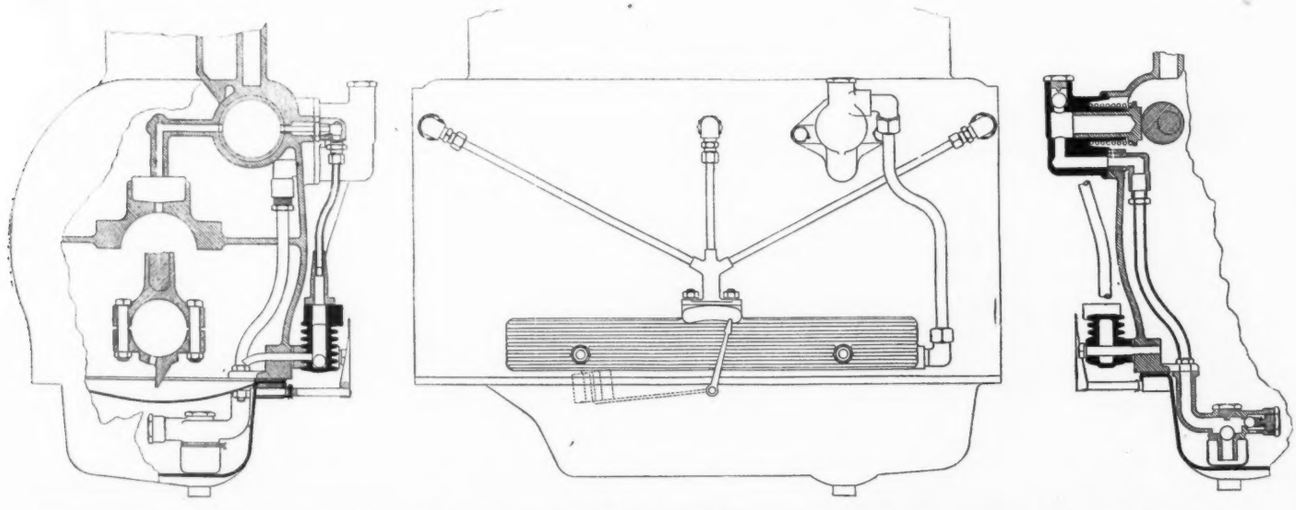
During the year Buick has completed its line and will enter the 1917 season with a range of cars including a small four, a small six and a larger six, described on page 72. The small six is continued over from a year ago without change. The little four was introduced in July and is being turned out in large quantities, while the larger six is the latest addition and makes its appearance for the first time at the New York Show. The little four is recognizably Buick throughout. It has the familiar overhead valve arrangement and is a high efficiency type, as is seen from the output of 35 hp. from the displacement of 170 cu. in. This is close to 1 hp. for every 5 cu. in. displacement. One feature of this engine which is at variance with other Buicks is that the cylinder head is detachable. On the other Buicks the valves are mounted in cages directly in the cylinder head. The other features of the valve mechanism are the same as usual on Buick cars, the push rods being external and the valve action exposed, but silenced by the use of felt washers at the top or ball end of the push rod. A feature which is doubtless a factor in the efficiency is the size of the gas ports. The valves are 1½ in. and the passages as direct as possible. The waterjacket space is also liberal. In the drive there is a cone clutch and a three-speed gearbox, behind which is mounted a single universal which acts as a pivot point for the entire rear system and takes the torque. The drive thrust is taken by the rear springs. A departure from practice on the other models is in the use of semi-elliptic springs. On both the other models they are cantilever.—*Buick Motor Co., Flint, Mich.*

Case

Unaltered in any important respect the engine of the Case forty has been simplified by the abandonment of the cross shaft for the generator, and the chain layout for the front end drive has been replaced by helical gearing. The generator has been changed also and is now an Autolite, ignition being Connecticut. The two blade aluminum fan which was a characteristic of the 1916 model has been abandoned for a six blade pattern and the radiator is now a vertical tube type made in the Case shops. The rear axle is a Salisbury. The unique mounting of the rear end of the cantilever springs on ball and socket joints is continued, having worked out well and shown itself to be rattle-proof. The front compartment of the body has been designed, and the brake lever moved from the left to the center position.—*J. I. Case Threshing Mch. Co., Racine, Wis.*

Chevrolet

There is an eight-cylinder Chevrolet described on page 80, as well as the two fours. The principal change in the four-ninety is the adoption of quarter-elliptic front springs the bottom leaf being much wider than usual as it has to act as a radius rod and must be absolutely proof against breakage. On the Baby Grand four, cantilever rear springs are a novelty and the wheelbase is now 112 instead of 106 in. Stewart vacuum fuel feed is used instead of air pressure. It is stated that the use of higher grade steels has permitted a reduction on 150 lb. in the weight. A three-quarter float-



Oiling system of Harroun. The ribbed chamber on the side of the crankcase is used to cool the oil as it circulates. The supply is sent to the main engine bearings by way of grooves round the camshaft bearings

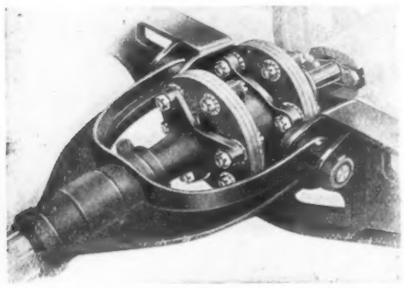
ing axle replaces the semi-floating.—*Chevrolet Motor Co., Flint, Mich.*

Crow-Elkhart

This chassis is unchanged, except that the wheelbase is 114 in. instead of 112, and the tonneau 3 in. longer in order to permit the fitting of two auxiliary seats. The bodies have been entirely redesigned.—*Crow Motor Car Co., Elkhart, Ind.*

Dodge

Dodge cars are larger this year. The wheelbase has been increased 3½ in. from 110 to 113½ making the car longer and the radiator and corresponding lines have been raised on account of a 2 in. increase in height. Thus the entire car is correspondingly more roomy. Mechanically the power-plant remains the same and what changes there are, occur in the drive units. The clutch, front universal and rear axle are the members which have had the alterations. The clutch has been changed altogether being now a multiple dry plate whereas a year ago a cone clutch was used. The new member is smoother and is quicker in its disengagement. The gearshift is easier also with the new clutch as there is no tendency for the gears to cling in mesh. The front universal has been redesigned and is now a substantial ball joint, forming part of the assembly at the front end of the torque tube. This is a straight ball joint with no exceptional features. The strength factor however is noteworthy at this point. The change in the rear axle consists in the adoption of the spiral bevel gear in place of the straight bevel used a year ago. With the fitting of this member together with the clutch and universal mentioned a high-capacity drive has been given which ranks well up with cars of greater weight. A few other minor details will be noted: The ignition which was by magneto is now Delco along with the lighting and starting. There are now splash guards on the front of the radiator and also on the fenders. A new convertible sedan has just been added. It has divided front seats and fills the requirements of a combination summer and winter vehicle. All the side windows and the rear window are removable giving in effect a touring car with the top up when the sedan is not desired.—*Dodge Bros., Detroit, Mich.*



Leather universal which is being continued as Overland practice for the second year

Dort

Dort cars are mechanically the same as they were a year ago. In a general way alterations have been made to improve the appearance and refine certain details to make the car more comfortable. Three new types of body have also been brought out, these being a sedan, a three-passenger roadster and a convertible sedan type applicable to the touring car body. The upholstery now conforms with the long pleat or pipe style, which is rapidly replacing button upholstery.—*Dort Motor Car Co., Flint, Mich.*

Elcar

This is one of the cars on which a cone clutch has been replaced by a dry disk. A full floating type of rear axle is now used with spiral bevel gearing, and the electrical equipment is now Dyneto.—*Elkhart Carriage & Motor Car Co., Elkhart, Ind.*

Empire

The four-cylinder Empire has not been changed, although a new high speed model is to be announced shortly. The company produces a six-cylinder car which has been modified in several respects, and this is described on page 73. —*Empire Automobile Co., Indianapolis, Ind.*

Ford

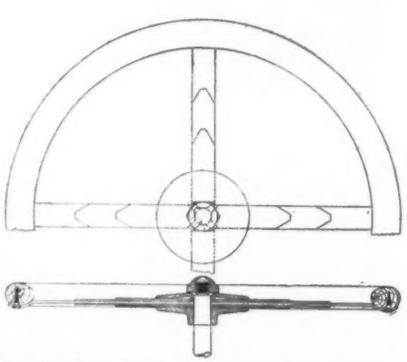
As compared with a year ago the Ford is an entirely new car in appearance. In the middle of August this year three changes were made. They were: the fitting of an entirely new radiator of black enamel, the use of the sloping hood and the addition of crown fenders. The new radiator reduces considerably the amount of brass used on the Ford car as it is a simple stamping in two pieces. These are first, the shell proper, and second, the top part carrying the Ford name plate. The new hood is provided with louvres. In addition to these changes there is also a shield fitted around the fan and an electric horn mounted at the right rear side of the cylinders. This is a vibrator type and arranged to operate from the current of the flywheel magneto.—*Ford Motor Co., Detroit, Mich.*

Hackett

This is an entirely new car, produced in the plant formerly owned by the Argo Motor Co. It has a detachable L-head cylinder on an aluminum crankcase. Combined pressure and splash oil is employed with plunger pump operated on one of the exhaust cams. A peculiarity of this engine is that the ends of the valve stems are threaded and provided with thimble nuts held by locknuts above them. These provide the tappet adjustment and also retain the springs. The clutch is a G. B. & S. and is one of the few disk types running in oil which now remain. Despite the lubrication, it uses fabric against steel, there being a single driven disk which is clamped between two fabric covered faces.—*Hackett, Mansel, Hackett, Jackson, Mich.*

Harroun

This, the most recently announced car, has a number of distinctive features in design. Outside the crankcase is a chamber for cooling the oil. This is a casting ribbed on the outside to give the greatest amount of radiating surface, and the oil is taken through it on the suction side of the pump. Another peculiarity is using the helical camshaft gear to drive a cross shaft which is used for the generator. The latter is an entirely new design of Bosch combining a magneto for ignition and a generator for lighting within one set of permanent magnets. The valves are overhead, operated by very long rockers and they are set at an angle somewhat like half the valves of a racing engine, and the spark plugs are located symmetrically with the valves. All of the combustion spaces are machined, there being exposed no rough casting. A pressed steel cone clutch is used, faced with asbestos fabric, and this is run in oil. Very rigid frame construction is used. An unusual feature in the steering gear consists of the employment of a



Leaf spring steering wheel used on Harroun

steering wheel with laminated springs as the spokes. This is claimed to remove vibration without affecting the actual steering operation. To get a large rake on the steering column, the connecting-rod operates across the car instead of fore and aft. Taken as a whole, the car is a remarkable combination of distinctive designs which are none the less very adaptable for manufacturing.—*Harroun Motor Corp., Detroit, Mich.*

Hupmobile

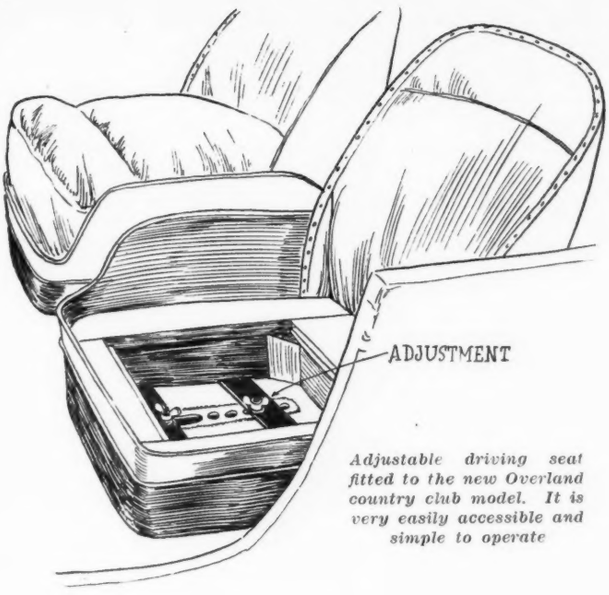
Only minor changes have been made on the Hupmobile and these consist largely in details of finish rather than in mechanical improvements. Probably the most important mechanical change is in the redesigning of the clutch linkage, allowing the clutch to be disengaged with much less effort. An innovation in the way of lighting is also a rather prominent feature of the 1917 Hupmobile. This is in the use of a new dimming device which gives graduated brilliance of the head lights. The tail light now operates independently of the other lamps and there is a new combination switch for ignition and lighting. Another electric improvement is in the ammeter which shows the rate of charge and discharge of battery. Previously no ammeter was fitted. In the body the most radical change is in the adoption of a new color, this being blue with the fenders black and an option of three colors for the wheels. There is a new type of demountable rim, the Firestone, and a new type of rim carrier to coincide with the latter. Some improvement has been made in the fittings of the car, particularly in the addition of Never-leak top, the material of which is black outside and tan inside. A special Hupmobile design of Bishop door curtain carriers is used. These fold with the curtains which is said to be an exclusive feature. The curtains also open with the doors in the latest approved fashion. A note which should be made in a review of the Hupmobile is the distinctiveness of its oiling system. This is probably the only car using a drilled crankshaft without an oil pump to force lubricant through it. Oil is picked up by the flywheel and thrown by centrifugal force into a bell mouthed opening in a pipe which conducts it through a screen and thence to the crankshaft. Oil also goes to the chain which drives the auxiliary shafts and a separate lead supplies the valve chamber so that the tappets operate in a constant bath. Owing to the use of the flywheel for lubrication the clutch is assured of plenty of oil and the type used is the steel-to-steel design with fifteen plates.—*Hupp Motor Car Corp., Detroit, Mich.*

Inter-State

No mechanical changes have been made in the Inter-State for 1917. There are alterations, however, in the body work. The divided front seat touring car now has the driver's seat arranged so that it can be moved backward or forward to suit the height of the operator. A change also has been made on the roadster in the shape of a door which has been added to the top of turtle back permitting access to the baggage compartment behind the front seat.—*Inter-State Motor Co., Muncie, Ind.*

Jeffery

The Jeffery Six is described on page 75. The chassis of the four-cylinder model has undergone no alteration, except in small detail. The maximum oil pressure has been raised and varies from 3 lb. to 30 lb. according to the speed of the car. More trouble has been taken in the accurate fit of bearings which are carefully scraped in by hand. The oil filler has been moved to the front end of the engine so that it is rendered as accessible as possible, since its previous location was not ideal in this respect. The tire pump has been transferred to the side of the transmission case and is arranged with a hose permanently attached, this being brought up



Adjustable driving seat fitted to the new Overland country club model. It is very easily accessible and simple to operate

underneath one of the front seats where it is coiled away. The emergency brake is placed on the rear end of the transmission and the brake lever is also attached at this point. Equalizers have been abandoned on the cross shaft of the rear brakes with the idea of eliminating lost motion. Both front and rear springs have been made more nearly flat under normal load and the car is slung lower, making it hold the road better for high speed. Both brake and gear levers have been lengthened, making them easier for the driver to reach.—*Nash Motors Co., Kenosha, Wis.*

Maibohm

This is a small car claimed to have a capacity for high speed. For the 3⅛ by 4 in. engine, the crankshaft used is 2¼ in. diameter and the piston and connecting-rod assemblies are carefully balanced and selected with the object of reducing vibration as much as possible. The pedals are provided with a long range of adjustment and the gear and brake levers are bent so as to come within easy reach, this being rendered necessary by the fact that the driver sits a considerable distance behind the engine. Another unusual point is the use of a single casting which combines both the exhaust and intake manifolds. The carbureter bolts directly to this manifold, thus the whole of the gas system is kept at a high temperature.—*Maibohm Motors Co., Racine, Wis.*

Maxwell

For the coming season the Maxwell car remains unchanged. There were a number of alterations that went into the 1916 production about a year ago and these have brought the car up to date so that no change has been found necessary. The changes which were made in the 1916 run are in line with well defined tendencies. Mechanically a higher volumetric efficiency has been secured from the power plant by better arrangement of the gas ports and a more efficient drive secured by changes in the transmission units. At the same time the entire car has been made to appear larger although the wheelbase remains unchanged at 103 in. by raising the radiator and making the other lines of the body to coincide. In the drive the most unique point about the Maxwell is the use of a cone clutch which runs in oil. Generally with a cone clutch every effort is made to keep the surfaces free from lubricant. On this clutch, however, an asbestos fabric facing is used which gives better action and longer life when it is allowed to run in the oil bath.

As would be expected with the lubricated clutch the co-efficient of friction is greatly reduced and this has to be made up by greater pressure. A heavier coil spring is used to hold the clutch in engagement than was used with the former unit. Another change which was made in the clutch simultaneously with the adoption of the fabric facing is the use of aluminum for the cone, thus reducing the weight of the driven member.—*Maxwell Motor Co., Inc., Detroit, Mich.*

Mercer

In a general way this car has not been altered, but there are a number of detail improvements. In the engine the arrangement of the rings and the fit of the pistons has been modified a little with the idea of minimizing smoking, but there have been no other alterations. The multiple disk clutch, which is of the dry type, now has the external edge of the plates serrated continuously, this being in place of eight projecting lugs which were employed previously. The effect of this, of course, is to give the clutch plate a much longer bearing in the housing. Both the front and rear springs have been stiffened up a little. In other respects, both as regards the body and the chassis, the design remains almost unchanged.—*Mercer Automobile Co., Trenton, N. J.*

Metz

The principal change is a reduction in the weights of the reciprocating parts in order to obtain smoother operation and the equipment of the car has been improved despite a slight decrease in price. The Metz Co. has been a persistent upholder of frictional transmission, and is still using practically the original design.—*Metz Co., Waltham, Mass.*

Moline

There have been a number of detail changes in the Knight engine, noticeable among them being the abandonment of a connection between the carburetor throttle and the oil system. This was previously set so that oil pressure should vary the throttle position, but the device was found to be subject to abuse by maladjustment, and the gear pump has been substituted, this of course varying the pressure with the speed. Two chains are now used, one to drive the camshaft and the other the generator, these replacing the one chain which previously did both. A new exhaust manifold separates the discharges from the cylinders in order to reduce back pressure. The oil filler has been moved so that its accessibility is improved, and a pressed steel fan has been substituted for the cast aluminum. In the electrical equipment the 6-volt instead of the 12-volt system is adopted. Instead of using the full Brush frame, that portion which forms the running board and the ends of the fenders has been abandoned, the running board now being wood. The rest of the frame, however, is of the Brush type and the Brush double transverse rear spring is still used.—*Moline Automobile Co., East Moline, Ill.*

Phianna

This is an extremely high-priced chassis of a typical European style. It is intended to be especially suitable for town cars. The frame is particularly rigid and the cantilever rear springs are the longest on any car in the world. In most respects the engine follows the Italian school of design, nearly everything being concealed as much as possible. The water pump, for example, is enclosed by one of the crankcase arms. There is no fan, the flywheel being cast with blades on its outer circumference. Leather boots are fitted to the springs and these are filled with non-fluid oil. It is one of the most distinctive cars in an engineering sense, since its designers have, at no point, permitted cost to receive any consideration whatsoever.—*Phianna Motor Co., Newark, N. J.*

Monroe

A new Monroe car on a 115-in. wheelbase chassis has just been put out. Previously Monroe cars have been built only as roadsters, but the new vehicle is a touring design throughout. It has the modern straight line, center cowl effect and embraces the latest in construction ideas, particularly in the frame, which is the deep section design covered by the Brush patents, in which the mud aprons and running boards are part of the structure. The powerplant is also a Brush design, incorporating his overhead valve gear on a block cast 3¼ by 4½ in. engine. A two-bearing crankshaft is used with force feed lubrication through a hollow crankshaft. The driving units consist of a multiple-disk clutch, six dry plates, two universals and a floating axle with the M. & S. differential. In the structural part of the frame, the general layout of the Brush deep side-member arrangement is used. The longitudinal members are 6 in. in depth, with the steel running boards hot-riveted to the side members, forming part of the frame. This design makes it unnecessary to use heavy sills for the body and also does away with the step hangers and the side shields. The entire assembly has the effect of strength with minimum weight. Compound cantilever rear springs are used, mounted across the rear of the chassis. This type of spring, which is a rather novel type, is noted for its elimination of side sway. In the Monroe application it is fitted throughout with self-lubricating shackles, which tend to reduce the necessity for frequent attention and also add to the life of the parts and produces quietness. Semi-elliptic springs of the conventional type are in front.—*Monroe Motor Co., Pontiac, Mich.*

Overland

As before, there are two four-cylinder Overlands and a Six. The larger of the two Fours is unchanged except for body alterations. The smaller, which supplants the model 75 put on the market in the fall of 1915, is known as the model 90. This is a larger car with the same size engine and partakes generally of the characteristics of the model 75. Two wheelbases will be made. The shorter of these takes a roadster body and a new body known as the Country Club car. This wheelbase is 104 in. On the larger, with 106-in. wheelbase, a five-passenger touring body is fitted. Vacuum fuel feed is used instead of the previous cowl tank and the touring body is entirely redesigned. The Six is mentioned on page 77. For the Knight engine cars see Willys-Knight in the four-cylinder section and also in the section for Eights and Twelves, pages 70 and 100.—*Willys-Overland Co., Toledo, Ohio.*

Cantilever rear Suspension used on Overlands

Princess

A 4-in. addition to the wheelbase and the adoption of a full floating rear axle, together with a two-unit instead of a single-unit electric system, form the principal changes. The brakes have been increased in size. In the G. B. & S. power plant practically no changes have been made of

importance. Magneto ignition is used, and the front end drive is a silent chain layout with a separate chain for the generator.—*Princess Motor Car Co., Detroit, Mich.*

Pullman

Changes made tend mainly toward greater driving convenience, as for instance the addition of an adjustment to the pedals. Another thing making for convenience is the removal of the junction box to a new location on the cowl board. A full pedal now replaces the former button type accelerator. Instead of the cowl gas tank there is a rear tank on the chassis and a Carter tank supplies fuel to the carbureter. The electric system is also new, being now two-unit instead of single.—*Pullman Motor Car Co., York, Pa.*

Reo

The six-cylinder Reo is described on page 80. On the four the body has been unchanged and the chassis has not been altered materially. The powerplant has a few detailed alterations, such as fins on the exhaust pipe to preheat the air, the same valve lifter improvement as is on the six and an improved type of Johnson carbureter. The clutch bushings are now oiled positively, and the new thermoid disk coupling has been placed between the engine and gearset. The four also has the Remy lighting system with thermostatic regulation. Two outstanding features of Reo design have been carried through in the new products. These are an engine in which the intakes are overhead and the exhaust on the side and the separate amidship gearbox. With this engine arrangement the simple exhaust manifold of the L-head engine is maintained with the advantage of the overhead intake, admitting the intake gases directly into the center of the combustion chamber. Advantage has been taken of the space between the rear end of the engine and the forward end of the gearbox to mount the starting motor clear of either the engine or gearset, cranking through the clutch shaft instead of by means of the flywheel. In connection with this there is an ingenious ratchet arrangement by means of which the starting motor is released as soon as the gasoline engine starts to run.—*Reo Motor Car Co., Lansing, Mich.*

Regal

An entirely new four-cylinder car has been brought out by Regal during this year. The car has been on the market since the end of June and is known as the 4 Thirty-two. The new motor, which operates at higher speed than any of the previous Regals, is rated normally at 32 hp. It has a displacement of 183 cu. in. and has the upper half of the crankcase in unit with the cylinder block. The principal claim made by the engineering department of the Regal company for the unit crankcase and cylinders outside of the manufacturing advantages is that it is possible to secure correct alignment of all the cylinders and bearings. An unusual feature is in the length of the pistons. These are cast iron measuring 4½ in. from top to bottom, affording a long bearing surface and cutting out any chance of slap. Three eccentric rings are fitted and there are oil grooves at the bottom of the skirt, besides a chamfered groove below the last ring slot. The piston pins are ¾ in. diameter and secured to the pistons by tapered dowel screws.

The new Heinze starting and lighting system is fitted and, as compared with the chassis of a year ago, the spring design is entirely different, the drive changed and a better axle adopted. The gasoline tank has also been removed from the cowl and placed at the rear, with an entirely new form of body. The new Heinze electrical apparatus combined with the magneto and generator with the coil and regulating switch mounted on the back of the dash.

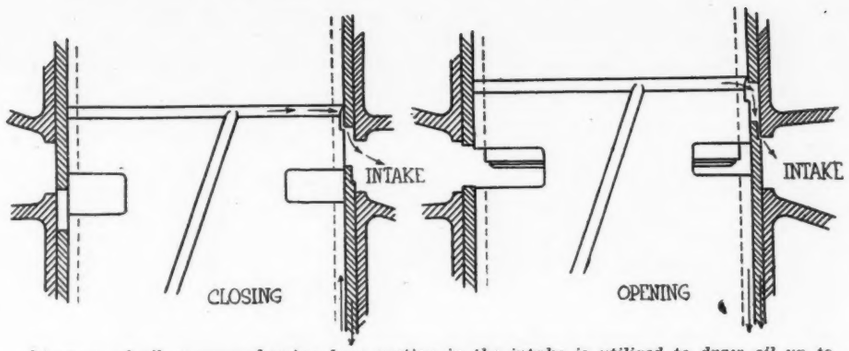


Diagram of oil grooves showing how suction in the intake is utilized to draw oil up to the sleeves in the Willys-Knight engines

The new clutch is a cone of pressed steel with a self-aligning ball thrust bearing and spring adjustment is obtained by nuts back of the bearing. There is another thrust bearing back of the spring to take the load when the clutch is thrown out of engagement. The chasis frame is new to Regal construction, in that it is designed to follow the body line and act as a direct support. The section is 3½ in. deep, with the flanges widened at points where bends occur. A radiator shield has been added between the front frame members.—*Regal Motor Car Co., Detroit, Mich.*

Saxon

A number of important changes both in the bodies and mechanically make the new Saxons considerably improved cars. The Saxon four has been brought up to the demands of the public for fully equipped cars by supplying it with full electric equipment, including a two-unit Wagner starting and lighting system, an electric horn and a speedometer. The tires also have been increased from 28 by 3 to 30 by 3 on demountable rims. Last year the starting and lighting equipment was extra, but is now regular.

The six is also a much better appearing car than its predecessor, the improvement being largely in the alteration of the body lines. The body itself is 4½ in. longer, wider, and in every way more roomy. It is fitted with a slanting windshield and crowned fenders. There have been a greater number of mechanical changes in the six, which is described on page 80.—*Saxon Motor Car Co., Detroit, Mich.*

Scripps-Booth

The Scripps-Booth eight has been continued without change and a new four added. This latest product incorporates a 3 11-16 by 4 I-head motor with the Brush valve gear, in which adjustments can be made while the engine is running. This is a block-cast design with all the parts enclosed, the crankcase being extended to incorporate a bell housing for the flywheel and gearbox. Lubrication is by a double plunger pump, giving both pressure and splash feed, with an oil pressure indicator mounted on the instrument board. The carbureter is a Zenith, and ignition, lighting and starting by the Remy six-volt, double-unit system, with the generator driven off the timing gears and the Bendix drive for the starting motor operated by a floor board switch. The headlights carry two-bulb dimmers. The drive is transmitted through a leather faced cone clutch with six auxiliary easy-engaging springs. From this it passes through a three-speed gearbox with nickel steel gears to a tubular propeller shaft with a Spicer universal at each end. The rear axle is a three-quarter floating carried on Hyatt high duty roller and New Departure bearings. Five wheels are supplied. They are the Houk wire detachable, triple-laced type with 30 by

3½ Goodyear, United States or Firestone clincher tires. The rear springs are full cantilever equipped with oilless bushings. The wheelbase of the car is 110 in. and it is made up in roadster and coupe form.—*Scripps-Booth Corp., Detroit, Mich.*

Stearns-Knight

There is an eight-cylinder model described on page 100. In the light four there have been no changes during the year. The outstanding characteristics are somewhat European in style, including a foot brake on the back of the gearbox. Last year the electric equipment was rearranged to improve accessibility, but no other engine changes were made; the car is substantially the same as when first introduced. This engine has one detail that is unique and a particularly clever idea. The oil filler and breather is carried up to a considerable height at the front end of the engine, and is made to serve as a fan support. From the fan bearings a wick is taken through a small passage, so that its lower end hangs down inside the oil filler, thus the fan bearings receive a fresh supply of lubricant automatically every time the engine base is filled.—*F. B. Stearns Co., Cleveland, Ohio.*

Studebaker

Studebaker is continuing its four and six standardized models with several minor changes. Better engine performance has been secured this year by the reduction of 12½ per cent on the weight of the reciprocating parts. By milling the skirts of the pistons it has been possible to cut off 5 oz. A tighter fitting oil pump is also used this year, thus increasing the pumping capacity and making priming positive. The rear axle has been strengthened and stiffened, giving a higher factor of safety in the entire rear structure and in the electrical equipment alterations have resulted in a 12 per cent increase in cranking power of the starting motor. This has been accomplished by a more efficient winding of the motor. The generator also has been improved in the winding, the practical results being in 3 amp. more current being supplied the battery at a car speed of 15 m.p.h., while the maximum output has not been altered. This gives a better supply of current for the car that is driven slowly without damaging the battery of the car that is driven at the higher speed ranges. Another change is in the headlight mounting, as the lamps can now be turned and fastened in any direction.

From a manufacturing standpoint, the Studebaker cars are interesting because of their standardization. The two power plants are exactly alike in design, except that one is a four and the other is a six. It will be remembered that these cars were redesigned for the 1916 season to secure this standardization and also to bring the product up to date. This plan has worked out successfully, as is evidenced by the few changes that it has been found necessary to make during the year.

In the first 1916 cars the cowl tank was used, but this was supplanted during the year by the rear tank and vacuum feed. No other changes except the structural ones necessary were made at that time. The rear axle gearset is one of the features of Studebaker cars, and this is continued in the same form.—*Studebaker Corp. of America, Detroit, Mich.*

Stutz

To this company belongs the honor of placing the first sixteen-valve engine on the market. The engine is a Wisconsin and of T head formation, there being two valves on each side of the cylinder and, of course, two camshafts. The engine has a piston displacement of 360 cu. in. and with its large breathing capacity given by the sixteen valves it is of very large b.hp. The cylinders are block cast and, with the valves inclosed, it does not look much like a T head. It is one of the neatest engines of this cylinder shape ever produced. Like all Wisconsin engines, it has pressure lubrication and pump water circulation, the water spaces in the cylinder being made to encircle the valve seats completely. A neat feature is the use of through bolts with collars countersunk in the crankcase, both for holding the main bearing caps and for retaining the cylinder block on the aluminum crankcase. The breather is concealed within one of the crankcase arms, this being so as to prevent the oil vapor from coating the engine all over, and the oil filler is used as the fan support, being a vertical tube attached to the front end of the crankcase and provided with a steady against the cylinder block. There are two intake ports to the cylinder, each serving four valves and two cylinders; outside there is a water-jacketed manifold which is quite short and holds the carbureter close against the cylinders. In addition to this speed model, which is being equipped with roadster bodies only, the standard four has been retained and has only one alteration, this being the substitution of a 58 in. for a 50 in. rear spring.—*Stutz Motor Car Co., Indianapolis, Ind.*

White

White is just starting to produce a sixteen-valve four. Accompanying the new model there are a number of changes and innovations on the chassis which are notable departures from previous White-practice. This is the first White motor to have a unit power plant, and it incorporates a plain bearing crankshaft instead of the ball bearing type as continued on the other models. The cylinders have removable heads, the oil is carried in the lower part of the aluminum crankcase instead of in a dash reservoir, and the entire appearance of the unit does not resemble the previous products in any way. All through the new chassis are a number of alterations which mark an advancement in design. There is a cane type of gearshift lever with a standard gate instead of the cross over arrangement formerly used. The brake lever is in the center instead of the left side, allowing a clear passage through this door, the springs are semi-elliptic and the spare tires are carried at the rear instead of in a well on the left side. The chassis is made in two wheelbases, 137½ for the touring, limousine and landaulet and 124½ in. for the runabout, sedan and coupé. A unit power plant is incorporated with three-point suspension. The 4¼ by 5¾ T-head cylinders are cast in a block with the valves located at the four corners of the square and symetrically about the cylinder circle.

The head is separate and contains no valve plugs, but the plugs are screwed through the center of the head and fall in the diametrical center of the cylinder. There are two independent camshafts, each carrying eight cams. These are driven by helical gear off the crankshaft, the timing gears being located in an independent box at the front of the crankcase. A feature of the valves is that they are set on an angle to the vertical center plane to reduce the size of the combustion chamber and allow plenty of water around the valves. Lubrication is full pressure by a gear pump and for lighting and starting the Leece-Neville system is used. Ignition is by single high-tension magneto.—*White Motor Co., Cleveland.*

Willys-Knight

Except for certain modifications in the body, which is much handsomer in outline and considerably better finished, the only change in the Willys-Knight Four is the substitution of Connecticut battery ignition for the magneto. The engine of this car was the first Knight motor to be produced on a quantity basis, but experience has shown it is no more difficult, with the proper equipment, to make a Knight engine in quantities than it is to make a satisfactory poppet

valve motor. There is now an eight-cylinder Willys-Knight described on page 100.—*Willys-Overland Co., Toledo, Ohio.*

Woods

This car operates on a unique system, being half a gas car and half an electric one. It is really an electric car with a gas engine to keep the battery always fully charged; an electric car that can be driven for days, weeks or months without getting a charge. The engine is very small and is built in a unit with a motor generator. There is a good-sized battery, enough to run the car many miles unaided, and there are two control levers on the steering column. On starting the battery drives the motor generator, starting both car and gasoline engines. The latter is controlled by one lever, the second lever being an electric control only. Once started and brought to a certain steady speed the gas engine does all the driving. If the car slows down the gas engine charges the battery; if we open up on the electric control the battery discharges and helps the gas engine to drive the car. Thus one may drive on the gas lever only for a certain range of speed, using the electric control for acceleration and for bursts of speed. The gas engine is extremely small and runs fairly fast most of the time, this meaning that it runs at its most efficient speed and is therefore very economical of fuel. The car is especially interesting because it is the first practical example of an ideal which has been a constant subject of discussion for over 20 years.—*Woods Motor Vehicle Co., Chicago, Ill.*

Section 2—Cars with Six-Cylinders

Abbott

Using a Continental engine and other stock parts of equivalent grade the Abbott six introduced a year ago has been changed only in small detail. The eight-cylinder model is no longer listed. The six is one of the cars that has adopted the Borg & Beck single plate clutch, uses a Grant Lees gearset and Salisbury axles. There are six new bodies covering all types to be obtained for the one chassis all on the same 122-in. wheelbase.—*Abbott Co., Detroit.*

Anderson

Possessing the distinction of being the first automobile to be built in the South, the Anderson is a carefully assembled chassis made from stock parts with a body built in the Anderson factory. A Continental engine is used, and the equipment is rather above the average of completeness. The special mechanical feature is the provision of an extra large amount of space between axles and frame, so as to permit greater amplitude of spring movement than usual on the rough roads of the South. At the front end the clearance is 5 in. and the spring 36 in. long, while the rear spring is 56 in. long and has a clearance of 8 in. before the axle touches the frame.—*Anderson Motor Co., Rock Hill, S. C.*

Auburn

This old established firm has this year cut off its four-cylinder model and is making only two sixes, these being of somewhat different design. The larger, with Continental engine has not been changed very much in specification. It is a substantially built car of 131 in. wheelbase intended for a capacious seven-passenger body. The smaller, has a Teetor engine and lighter parts generally. An alteration in the small car is in the springs, which are now semi-elliptic instead of cantilever, as they were last year, but the big six still has cantilever suspension. The cars are characterized by a low, and very long appearance, having extremely distinctive bodies which are entirely in keeping with modern ideas and yet possess a strong individuality.—*Auburn Automobile Co., Auburn, Ind.*

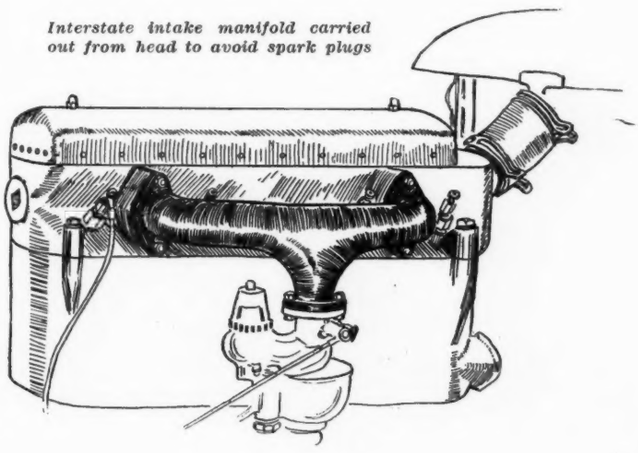
American

This is one of the newest cars of which deliveries are only just commencing. The engine is a special design with several interesting features. It is one of the most accessibly arranged power plants, the electric and other engine accessories being so disposed that one cannot interfere with another. An unconventional feature is that of supplying the water from the pump to the front end of the cylinder casting, a single casting being made to conduct the water from the pump and also carry the fan bracket. There is a large platform on the left of the crankcase which carries the generator and the ignition coil unit separately, the starter being on the opposite side. A special bracket is mounted on top of the bell housing to act as a support for the toe board, and in this bracket the starting switch is fixed, together with the accelerator pedal. All the accessories for the cowl board, including the terminals, etc., are assembled as one unit, and the wiring is all in another unit. A temporary attachment on the toe board bracket enables the wiring and accessory panel to be clipped in position and, as the Carter fuel feed is bolted to the cylinder side, the chassis can be driven without its body. The object of this is really to eliminate all connections between body and chassis, since the only attachment to be made after putting the body in place is to secure the instrument panel in the cowl board. The wiring is carried out with unusual neatness, especially for the headlamps, where the wire is carried up inside the lamp support, thus eliminating a long loop back of the lamp.—*American Motors Co., Plainfield, N. J.*

Apperson

The Apperson car for 1917 is known as the Roadaplane. The same chassis is used for either a six or an eight, the two engines being interchangeable. The six has a 3½ by 5 L-head block engine rated at 48 hp. and the eight 3⅛ by 5-type rated at 58 hp. The wheelbase in both is 128 in. A float feed, automatic type of carbureter, positive pressure feed lubrication, hollow crankshaft, vacuum gasoline feed, dual ignition system with distributer and storage battery, two-unit 6-volt starting and lighting system, disk clutch of the dry-plate type, selective sliding gear transmission with

Interstate intake manifold carried out from head to avoid spark plugs



three speeds forward and reverse, and worm and gear type of steering gear, are a few of the features of construction on both of the new models. Other features include: Tubular propeller shaft with two universal joints; shaft driven, demountable floating type of rear axle; I-beam, drop-forged front axle; semi-elliptic on rear; service brakes, external contracting, and emergency, internal expanding; and left drive with levers in center.—*Apperson Bros. Automobile Co., Kokomo, Ind.*

Bour-Davis

A few minor refinements have been made in the Bour-Davis car since it was first put on the market in about the middle of June this year. Since that time a tire pump driven from the gearset has been installed and the speedometer drive has been moved over to the transmission unit. On the body, improvements have been made by making it 1½ in. wider and 9 in. longer, the increase having been taken up in overhang without a change of wheelbase. The pedals also have been rearranged to accommodate themselves to the new position of the seats and the upholstery has been changed to straight piping instead of tufting. There is also a larger radiator, lifting the front lines of the car higher and giving a flatter effect. The car is made up of standard parts with a Continental engine, Detroit Gear & Machine Co. gearbox, Borg & Beck clutch, Remy ignition, Stromberg carbureter, and Ward-Leonard lighting and starting.—*Bour-Davis Motor Car Co., Detroit.*

Buick

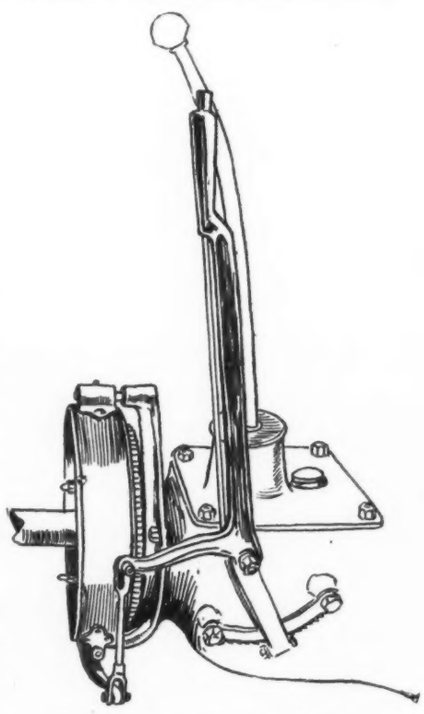
Buick has this year added a four, described on page 65. The small six will be continued without change and in response to the demand for a seven-passenger car of Buick manufacture a car of that capacity on a larger six cylinder chassis will be added. The first few of these chassis have been put for exhibition purposes on the show circuit and production will be actively started early in the spring. The new model does not supplant any of the Buick cars, but simply completes the line to include a car of larger passenger capacity. It is a valve-in-head type much along the lines of other Buicks with the exception of a few departures in the valve mechanism and in the drive. The most notable feature of the power plant is the fact that the intake valves are larger than the exhaust, in order to secure the highest possible volumetric efficiency on this size engine. Briefly, the engine is a block-cast 3⅜ by 4½ unit power plant with solid head, aluminum crankcase and pressed oil pan. The valve drive is by helical gear to an integral camshaft, with roller followers and external push rods, similar to other Buicks. The use of 1⅝-in. intake valves with 1¼-in. exhaust has made it better to stagger the valves and for this reason the rocker shaft brackets have been set at a slight angle to the centerline of the cylinders. The valves are in cages and otherwise are the same as on previous models. Ignition is by the Delco system with starting and lighting in a single unit. Carburetion is affected by the Marvel instrument and the cooling system has the feature of incorporating thermostatic control. Lubrication is by circulating splash with the oil led through a dash sight feed and thence to a pipe which travels the length of the crankcase. From the engine power is transmitted through a ten-plate dry disk clutch, then through a single ball universal to the rear axle. This ball universal is new. It takes the drive and the rear axle housing, being really a unit with the torque tube, it forms a solid member and the entire rear system rotates about this point. A particular feature is the automatic lubrication of the part from the gearbox supply. A floating rear axle with a free type of cantilever spring keeps the rear system in line with previous Buick practice. A new steering layout is used, however, to conform with the greater wheelbase. This dimension is 124 in. on the seven-passenger car. The tire size is 34 by 4½ in. A straight frame is used with parallel frame members, having a kick-up over the rear axle. An entirely new body has been placed on this car, and it is particularly designed for the chassis and passenger capacity, by no means being a five-passenger car with two seats added.—*Buick Motor Co., Flint, Mich.*

Chandler

The Chandler 1917 chassis remains unchanged since its announcement during the early months of 1916. Some new closed bodies have recently been added in the form of a convertible coupé and a convertible sedan. Both are Springfield types and have seating capacities of four and seven. No new features of an engineering nature are to be noted.

Chalmers

Taking their light six practically unchanged from the 1916 to the 1917 season, the Chalmers Co. have been concentrating upon manufacturing detail so as to produce the design in the best possible way. Practically the only alteration in design is the use of larger brakes, the idea being to make the action lighter by reason of the greater diameter and, still more, to render the need for adjustment less frequent by reason of the larger rubbing surfaces provided. An interesting discovery made with the small six is that it has proved unexpectedly good in resisting the development of squeaks or rattles either in the frame or springs. This is attributed to the straight rail frame adopted when designing the new model a little over a year ago. The high speed ability of the engine has not led to any changes in the lubrication system, which is pressure to the main bearings and splash for the remainder of the engine, and the success of the engine is thought to be largely wrapped up with the aluminum pistons and the carefully balanced crankshaft. The latter is tested on a very simple machine of Chalmer's own devising and the stock product will make nearly 2000 r.p.m. without periodic vibration. This is without the use of counterweights, but with a straight, forged crank having curved webs. This gives very good results without the expense of counterweights, but it is considered probable that a method will soon be found of forging the shaft so that it is partially balanced without adding to its price. Of course the lightness of the reciprocating parts and the stiffness of the crankshaft are important factors in keeping down the bearing loads, but the Chalmers lubricating system is worthy of note, being the highest speed application of splash-pressure used on any American engine.—*Chalmers Motor Car Co., Detroit.*



Mounting of Liberty hand brake

Davis

The most important mechanical change in the Davis sixes is the dropping of the platform rear spring and the sub-

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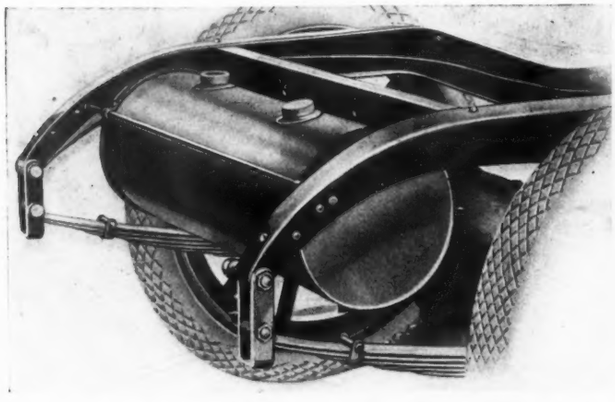
stitution of 56 in. semi-elliptic springs. Both have Continental engines and are made up of standard units. Columbia supplies the axles and Warner the transmissions. The shape of the hood has been improved, a slanted windshield added, and there is no break in the body lines in the cowl; the rear seat is wider and there is a tonneau light. Delco starting, lighting and ignition are standard on both models. Davis was one of the first to make a car with front seats individually adjustable and with the passenger's reversible.—*Davis Motor Car Co., Richmond, Ind.*

Detroiter

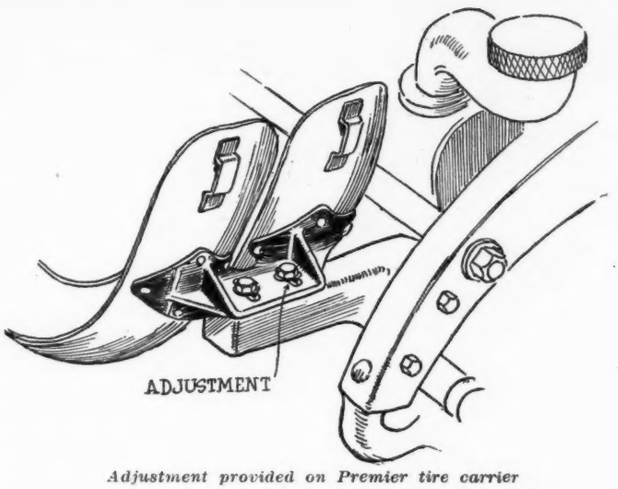
The Detroiter is one of the very few American cars that uses stranded steel cables for brake operation, although this absolutely does away with rattle and is common practice on the other side of the Atlantic, especially in France. There are cross shafts on the rear axle of the Detroiters and each pair of levers is connected together by a wire cable. Seen in plan, this forms a triangle with the apex toward the front of the car, and at this point there is a pulley and another length of cable going to the pedal or lever as the case may be. The levers on the axle are spaced so that the two triangles have each equal base angles. The right hand axle lever for the foot brake is close to the center of the axle and the left lever close to the wheel, while the levers on the axle for the hand brake are set in a similar way, making the pulley, in each case, able to exert an equal pull on the axle levers. The layout is particularly neat and simple and well worthy of careful study. With a three-point suspended Continental power plant and a taper frame with straight side rails the Detroiter chassis is one of the cleanest among the many clean designs of 1917 automobiles.—*Detroiter Motor Car Co., Detroit, Mich.*

Dorris

There are two main changes in the Dorris six. The most obvious is the change from a unique starting system with a motor driving through a train of gears to the front end of the engine to the conventional Bendix with a gear ring on the flywheel. The other is the adoption of a full pressure oiling system. By means of a special cock it is made easy to drain the crankcase of the Dorris, and the makers strongly recommend that the used oil be thrown away frequently; it is undoubtedly the best system. The valves are overhead, being operated from a camshaft in the conventional position by push rods and rockers, and even these rockers are cared for by the forced oiling system. A Dorris peculiarity is the placing of the gasoline tank against the side of the frame, so that the filler and the gage come flush with the floor boards in the driver's compartment; the tank is inside the frame and so out of sight entirely. A detail of construction that is absolutely unique is the casting within the flywheel



Neat and inexpensive spring shackle used on Oaklands



Adjustment provided on Premier tire carrier

of a ring of forged steel, this being to strengthen the cast iron.—*Dorris Motor Car Co., St. Louis, Mo.*

Elgin

Apart from body improvements the principal change in the Elgin is the adoption of a 116 in. wheelbase instead of 114 in. A good deal of experimental work has been done on the springs also, and the result is improved riding. The rear springs are cantilever and the frame of the car is a straight side taper. The springs are mounted directly beneath the frame, and thus have a distinct spread at the rear end. It is thought that this is valuable in assisting to reduce rolling. The Borg & Beck clutch replaces the type formerly used, and a new two-unit Wagner system is employed for starting and lighting. There is rather more rigidity in the frame, so taking away stresses from the body sills.—*Elgin Motor Car Co., Chicago, Ill.*

Empire

Some particulars of the Empire four were given on page 66. There are two sixes for 1917. In the new six-cylinder car the adoption of Hotchkiss drive and a propeller shaft with two universals is to be noted. It is otherwise generally similar to the model 60 which is not changed. The clutch on the new model is a dry disk instead of a cone, and the make of gearset and rear axle is different from model 60. A very substantial frame has been chosen and this is rendered particularly strong to resist cross stresses by abnormally stiff gussetting at the rear end. There is a new body type for the new chassis. The open body is a five-passenger, with provision for the addition of two folding seats if desired, there being sufficient floor space to permit this, but the greater novelty is a sedan with removable glass and only two doors. This is said to be a strong, light body and there is a large compartment back of the rear seat where all the windows can be stowed when they are not wanted. The front seats in the sedan are, of course, divided. There is also a four-passenger roadster with an unusual amount of room in the rear compartment and plenty of luggage space also. The equipment is practically identical with that of the model 60.—*Empire Automobile Co., Indianapolis, Ind.*

Franklin

One of the lightest cars in the world for its capacity, the 1917 Franklin is lighter still than its forerunners. It is a smaller car, with a smaller engine of so much higher efficiency that there has been no decrease of power. The air cooling system is not altered, but the very expensive built-up flywheel which was made from innumerable sheet steel parts welded together has been replaced by a casting, giving just

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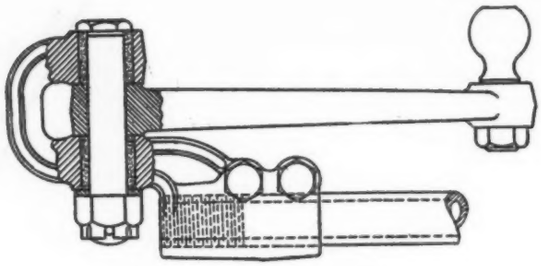


New steering swivel on King

as fine fan action to provide the draft through the air jackets. This flywheel is a beautiful bit of foundry work. From the engine, by the reduction in size and by reducing the dimensions of parts of the valve gear, etc., 150 lb. has been trimmed, and the gearset, the axles and nearly all other parts are lighter; some a pound or two, and some merely by ounces. The wood frame is as heavy as ever, and the body is actually a little heavier than it was last year. There are no important design changes. The gearset now has the shafts one above the other instead of side by side, this being to reduce the size of the case and so save weight; also the brake lever is now mounted on the frame to the driver's left. Franklin uses a unique oiling system, there being individual leads to almost every point where oil is required. An oil pump of the gear type supplies a distributor with a number of pipes leading from it, and the oil is delivered to each in turn as the distributor revolves. The details of this distributor are worth examination as examples of die-cast aluminum. Aluminum alloy pistons are employed, but a deep groove is turned all down the skirts. This is of square section and helical formation, its purpose being to carry a good body of oil, so overcoming the trouble that might otherwise arise from using a metal with a high coefficient of expansion in an engine working with a higher mean temperature than the normal for water-cooled cars. Externally there has been a big alteration, as the taper hood of Renault style now joins the cowl flush all around, eliminating the break in line that used to occur at the junction. —*Franklin Automobile Co., Syracuse, N. Y.*

Glide

The principal change in the Glide, which is practically the 1916 model continued, is in the engine, which is a Continental of 3⅛-in. bore as against the 3-in. bore of the former model. This is a detachable head engine with a crankshaft 2 in. in diameter. The electrical equipment is entirely Westinghouse, including the ignition distributor and all the switch gear. There are several body styles, of which the newest is a four-passenger for the rear compartment, of which especial roominess is claimed. The cramping of the nether limbs of the rear passengers is avoided by copying the dimensions of the front compartment, arranging the toe boards similarly to those for the driver.—*The Bartholomew Co., Peoria, Ill.*

Grant

Grant cars for 1917 were brought out in the middle of June. The company has just moved to its plant in Cleveland, where the most up-to-date progressive system has been installed and it is very possible that word of innovations may be issued shortly. Silence has been one of the main objectives of the Grant company this year, and one of the most interesting features is that the housing over the overhead valve rockers which was installed in the first place to secure silence was removed because it defeated its own purpose. The reason is that people would not take the trouble to remove the cover to get at the valves to lubricate them and eventually they became noisy. Large oil cups have also been installed to insure that the two rocker shafts will not be overlooked. The new Stromberg carbureter connects directly to the cylinder head with gas distribution being taken care of within the casting. In the previous design there were two inlet connections to the head unit with a double manifold. Now there is no external manifold at all. The ignition was changed to Remy during the year, but no alteration in the method of drive from the rear end of the camshaft was made. A two-unit Wagner starting and lighting system also replaced the single unit type formerly used.—*Grant Motor Car Corp., Cleveland.*

Haynes

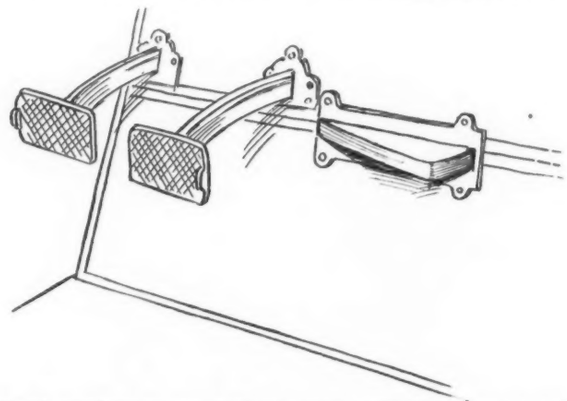
At the last New York show the twelve-cylinder Haynes was announced and some features of this are given on page 81. The six-cylinder has not been altered in any way, the factory having devoted the whole of its attention this year to increasing the volume of the output. One of the oldest cars in the United States, the Haynes is made practically throughout in the one plant. It is at present the principal user of the Leece-Neville two-unit electric system.—*Haynes Automobile Co., Kokomo, Ind.*

Hollier

Entering the field a little over a year ago with the cheapest eight-cylinder car, which is unchanged, the producers of the Hollier have this year added a six. In general respects, the two chassis are similar with a straight side frame, cantilever rear springs and the propeller shaft inclosed in a long torque tube. The gearset is attached to the engine by two arms. The six-cylinder engine has overhead valves and a detachable head.—*Lewis Spring & Axle Co., Chelsea, Mich.*

Hudson

The Hudson Super-six is now just a year old and mechanically remains the same. This model was introduced at the show a year ago and was featured by the use of a crankshaft designed particularly to permit of high rotative speeds. This car introduced the discussion on counterbalanced crankshafts which has been one of the features of engineering discussions during the year. A new oiling system was employed on this car to take care of the higher speeds of the engine. The principle used is the constant level splash with the oil pump mounted at the front end of the engine drawing oil from the 3-gal. reservoir and delivering it to the timing gear housing from where it passes back to the splash troughs. The splash is carried particularly to channels in the side of the case which lead directly to the main bearings. The splash keeps these channels filled. An unusual feature is the connection of the carbureter control with the oil pump to regulate the flow in proportion to the load. A point of simplicity is in the connection of the water pump to the cylinders. This bolts directly to the casting, thereby elimi-



Novel accelerator on Westcott which allows the foot to be pressed firmly against the toeboard whatever the throttle position

nating any pipes or exterior hose connections. One refinement that Hudson has added during the year is the placing of the temperature control of the water directly into the driver's hands. A shutter is fitted to the radiator which can close off all access to the air in front or can be left open altogether without materially reducing the effective surface. Between these two extremes lies a range of temperature control that can render the running temperature correct for winter or summer. A Boyce moto-meter completes the outfit, enabling the driver at all times to run the engine at the most efficient temperature. A number of little body refinements have also been added, bringing the car up to the 1917 standard.—*Hudson Motor Car Co., Detroit.*

Jeffery

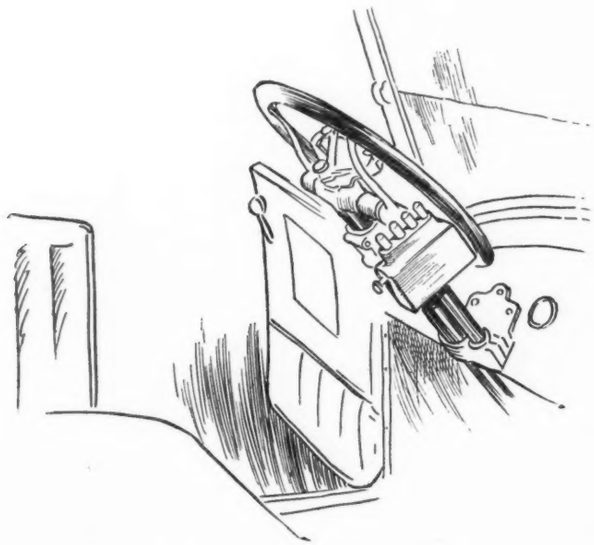
On page 67 a number of the small changes made in the Jeffery four are described and these apply also to the six-cylinder model. The latter is a new car which is larger than the previous Jeffery six and resembles the four-cylinder job much more closely. For example, the hand brake is located on the back of the gearbox and another brake feature is the mounting of the pull rods on the rear brakes outside the frame, and even outside the spring, this making them very accessible. A very large crankshaft is used and in a general way the engine is a neat conventional L-head job. A notable point in the design is that the strainer and oil pump can be removed from the bottom of the crankcase without disturbing the other parts.—*Nash Motors Co., Kenosha, Wis.*

Jordan

Making its appearance last summer, the Jordan has a chassis assembled from the highest grade stock parts put together with due regard for the convenience of the driver, but possessing no particularly distinctive features. The object has been to have a chassis of which each unit is so well known that it could be relied upon entirely. On the other hand, there is plenty of originality in the bodywork and the springs have been very well worked out. The Jordan was the first car to be announced with the Marshall upholstery spring which is now being used for a number of very high grade cars.—*Jordan Motor Car Co., Cleveland, Ohio.*

Kissel

Of the two sixes produced by Kissel, one is a continued model and the other an entirely new design, announced in June. This is a smaller car with a 117-in. wheelbase. The engine, which is made in the Ki... design with a detachable cylinde... the crankcase integral with the ... half is a pressed steel case, and t... wheel housing bolted to the iron c... gearset. A 2¼-in. crankshaft with ... A noticeable feature of the chassis is ... ternal brakes on the rear axle, the reas... the Kissel engineers believe it easier to ... brake which is free from rattle. Also, there a... grease cups on the car, oil containers wicked to t... surfaces being used instead.—*Kissel Motor Car Co., ford, Wis.*



Folding steering wheel on Premier

Lexington

A number of small improvements have been made in the Lexington, in fact, the list of them is entirely typical of the general trend this year. To improve the ease of driving, a clutch has been made with a softer engagement and both the clutch and brake pedals are adjustable over a wide range. Additional length has been put into the rear springs and their camber has been lessened, this being claimed to effect a great improvement in the suspension. The brake mechanism has been improved so as to eliminate lost motion and the flatter springs are, of course, of assistance in this regard. There are some body changes, the plan view showing still straighter lines on the sides owing to a wider cowl. In the front compartment 2 in. more leg room is given and the rear seat is 1 in. wider.—*Lexington-Howard Co., Connersville, Ind.*

Liberty

A new assembled car to make its appearance this year is the Liberty. The units of which it is composed such as the Continental six engine, Delco lighting and starting, Timken axles, Borg & Beck clutch, Detroit Gear & Machine Co. gearset, Rayfield carbureter, and Stewart vacuum feed, so clearly define the chassis that it need not be further described. The controls of clutch, brakes, steering and gear-shifting are extremely easy, in fact there are very few cars that can approach the Liberty in this respect. The body, however, is very distinctive, being built on a wheelbase of 115 in., there is ample room for a five-passenger touring car, with plenty of space in the front and rear compartments. The particularly striking feature is the straight lines along the sides of the hood and back to the rear of the tonneau. The Liberty was about the first car to be fitted with the new two-unit Delco starting, lighting and ignition system, in which the ignition distributer and coil are in unit with the generator. Another little feature which may be mentioned is the two-compartment gasoline tank in which one section acts as a reserve. This holds 3 gals. and is formed by means of a dividing wall, perforated by two ½ in. holes located well toward the top of the partition. When the main tank is filled to the height of these holes gasoline flows in to fill the reserve. Another little detail is at the side of the windshield. It is often difficult to make the side curtains fit tightly against rain or wind. To take care of this rubber strips have been provided here as well as at the bottom of the shield, thus sealing the compartment when the curtains are up. The curtains also open with the doors. There are no grease cups on the car but in place of them are oil cups.—*Liberty Motor Car Co., Detroit, Mich.*

Locomobile

The principal change in Locomobiles is that they are now 2 in. lower, this reduction in height being obtained by alterations in the springs. This has necessitated a new front axle in which the spring pads are lower but the road clearance is the same as before, and an increased kick-up at the lower end of the frame to compensate for a decrease in the camber of the spring. The starting motor, which is made to

mesh with the flywheel gear by a magnetic action, has now a 10 to 1 ratio, the double reduction gearing being abandoned. Another change in the starting system is that the flywheel ring gear is cut with the teeth at an angle of 30 deg. This gives a quieter engagement and a quicker disengagement. The pistons have been changed, now having two rings at the top and one at the bottom, instead of five rings each, and more metal is now machined from inside the piston. Throughout the car, forgings have replaced castings in various places and the material is better than ever.—*Locomobile Co. of America, Bridgeport, Conn.*

Madison

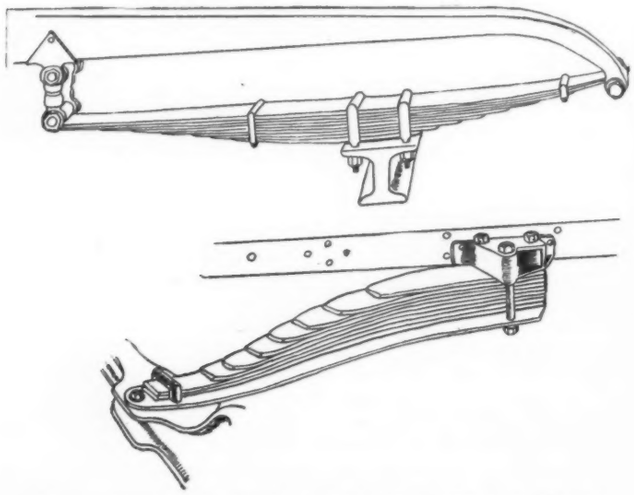
The Madison, which was a new car in 1915, is mechanically unchanged this year. The five-passenger body has been improved in detail and there is an entirely new four-passenger roadster. A characteristic of the Madison chassis is the use of exceptionally long three-quarter rear springs, and half-elliptic front springs which are above the average length. The rest of the chassis follows the best conventional practice, being laid out very neatly with a minimum of attachments to the frame which is a straight side pattern.—*Madison Motors Co., Anderson, Ind.*

Marion-Handley

An assembled car made from well known stock parts, the Marion-Handley is distinctly light for its power. It is stated that 1 b.hp. is available for approximately each 60 lb. weight. There are two chassis of generally similar design, the smaller engine being a Rutenber and the larger a Continental, both cars having Muncie transmission with multiple disk clutches and complete Westinghouse electric equipment, including ignition.—*Mutual Motors Co., Jackson, Mich.*

Marmon

Seeing that, when introduced a year ago, the Marmon was a completely new job containing many new ideas, it is particularly interesting to remark that no changes have had to be made. The aluminum cylinder engine has proved out well in the hands of the users, the Brush frame with double transverse rear springs and the new rear axle made from drawn conical steel tubes, have none of them developed any faults. During the fall a number of new closed bodies were announced, but the touring car has undergone very little change. Some experiments have been made with regard to car balance, it having been found possible to alter the position of the engine slightly relative to the axles and thus still further improve the already quite excellent steering. It will be remembered that this is an overhead valve engine and that the lubrication system is particularly thorough. It also embodies a control in connection with the carbureter throttle. Oil is fed to the hollow crankshaft and the long rocker shaft on the top is hollow and is connected to the release valve so that a supply of oil is sent to this point whenever this valve opens, and it naturally does so most readily when the throttle is wide open and the engine working hard. The oil control is a kind of large diameter cock placed on the suction side of the pump with a sufficient slackness of fit to insure an adequate supply at idling speeds even if it be adjusted so that the main passage is entirely closed. The point in connection with the springs apart from the rear end suspension is that the front springs have several reversed leaves on top, these having been added as the result of experiment and the front spring action is more satisfactory with this addition. In designing the new closed bodies, special attention has been given to keeping these low and of light weight. The roof of the limousine is barely 6 ft. above the ground and the same applies to the sedan.—*Nordyke & Marmon Co., Inc., Indianapolis, Ind.*



Above—Raked and unevenly divided front spring on Liberty. Below—Quarter-elliptic front spring on Chevrolet with heavy bottom leaf to act as radius rod

McFarlan

This is a large six-cylinder car of rugged construction built to carry heavy bodies and the specialty of the manufacturer is extreme comfort and luxury of equipment. The 1917 chassis is distinguished by the use of the Vesta clutch. In this the flywheel is an armature and inside it, with no connection to the crankshaft, are the field magnets. This reverses the ordinary commutator arrangement, making the brushes the internal member. The field magnet unit attaches to the propeller shaft. The device operates as a generator for battery charging and as a motor in starting the engine. As soon as the engine is running and the current is allowed to pass, a magnetic drag commences, the slip being in proportion to the resistance imposed. When the car gathers speed the centrifugal force throws the brushes outward, thus offering mechanical friction which assists the magnetic drag and gives practically a solid drive on high gear.—*McFarlan Motor Co., Connersville, Ind.*

Mitchell

A number of small detail changes have been made to the Mitchell, notably an improvement in the riding quality by using a reversed leaf on top of each front spring. A detachable cylinder head has been adopted. An oil pump and strainer are arranged accessibly on the outside of the crankcase. Drilled pistons are now used, this of course being to cut down their weight. A feature which is very unusual in America, but has been adopted extensively in Europe, is a combination of fan and water pump. There is the usual belt drive and the pump is situated behind the fan, thus acting as an impeller. The bracket which carries the fan and pump bolts direct to the cylinder casting forming the water connection, and the pump intake is through the usual pipe and rubber connection. In the event of fan belt trouble the system can operate as a thermo-syphon one. The headlamps are mounted in the new way, being attached to the radiator case, and the whole of the internal part of each lamp is hinged at the top of the case so that it can be pulled out and turned over, thus throwing a light rearward which is useful if any work has to be done on the car.—*Mitchell Motors Co., Inc., Racine, Wis.*

Moon

The most noticeable mechanical change in the two Moon models is the use of a two-unit Delco system, this including the ignition, which is furnished with automatic advance. Both models have Continental engines and other stock parts of a similar quality. Without changing the general character, the body lines have been improved and the radiator

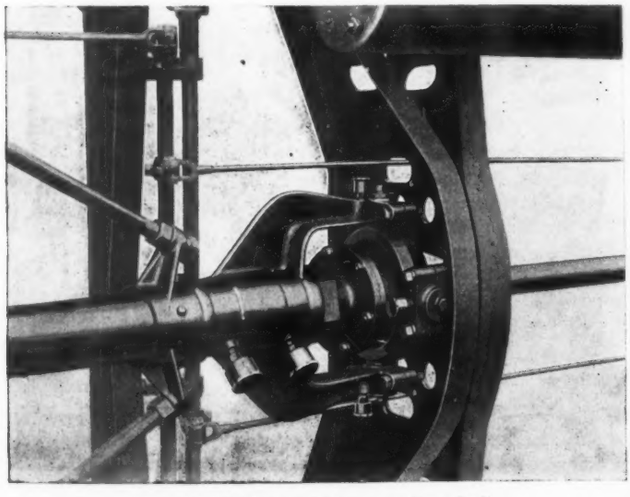
is rather higher. Some of the body dimensions have been changed, this being particularly noticeable in the four-passenger, which now has a larger rear compartment.—*Moon Motor Car Co., St. Louis, Mo.*

National

For the National Twelve description see page 100. The Six, which has a Continental engine, specially built for the National Co., is not much changed, and the two chassis are now pratically identical except for the engines. Rather more power is being obtained from the Six by careful attention to detail and the bodies for both cars are improved editions of those used last year. It will be remembered that National uses long cantilever springs that are exceptionally flat under normal load and are mounted in a way that supports the frame without side warping stresses. A rather large number of leaves is put in these springs.—*National Motor Vehicle Co., Indianapolis, Ind.*

Oakland

Oakland cars for 1917 are roomier, easier riding, and more powerful than their predecessors. A new body has been added and a number of detail mechanical changes incorporated. The exterior appearance is so much changed that it is difficult to compare the new body with the old. It is 6 in. longer, and of this, 5 in. has been taken up by increasing the depth of the tonneau and the other inch in enlarging the front compartments. Besides this, the radiator is entirely new, having a deeper shell and a flat instead of a rounded front. This refined model is known as 34 and is a continuation of the 32. Model 50, the eight-cylinder car, is continued without change. Although 6 in. has been added to the body, the wheelbase has been increased 2 in.—from 110 to 112. The additional body space has been secured by giving 4 in. more overhang in the rear. To take care of the larger capacity 32 by 4 tires are now fitted in place of the 32 by 3½. The new body is also easier riding through the adoption of 51 in. semi-elliptic springs in place of 40 in. three-quarter elliptics. The Hotchkiss drive has been continued with the new spring. Mechanically, the refinements are of a detailed nature, but have had practical results as is evidenced by the fact that an increase of 6 hp. has been given the engine without altering its dimensions. This is an overhead valve design and the principal difference is in a rearrangement of the valve timing and the use of an offset fulcrum on the valve rocker. This now gives a reduction of 2 to 1 whereas the former had a 1 to 1 arrangement. The result of this is a longer dwell or open period of the valve and taken in conjunction with a new timing, this gives a higher volumetric efficiency and hence the gain in power.



Trunnion bearing in Paige propeller shaft

The engine output is now 41 b.hp. at 2500 r.p.m. on the block. The only other change in the powerplant is in the use of a fabroil gear in the timing set. A change has been made in the rear axle ratio making it 4.5 to 1 in place of 4.25 to 1. The spare tire is placed in the left front fender instead of at the rear, the reason given being the solid platform support provided.—*Oakland Motor Car Co., Pontiac, Mich.*

Overland

The Overland Fours are mentioned on page 68. For the Knight engine cars see Willys-Knight in the four-cylinder section and also in the section for Eights and Twelves, pages 70 and 100. The only alteration to the Six, which has a Continental engine, is in the body work. This now has a center cowl and follows the general lines of the bodies fitted to the Willys-Knight eight. It has a sloping windshield and extremely roomy tonneau, and a detail of the equipment which is quite unusual is the provision of a rubber windshield cleaner. A Boyce Moto-Meter is included and the upholstery and finish generally are in keeping with the fine appearance of the vehicle. It will be remembered that Overland cars are now being fitted with Connecticut battery ignition instead of with a magneto.—*Willys-Overland Co., Toledo, Ohio.*

Owen Magnetic

Unchanged in any way in principle, the Owen is still offered in two sizes. To recapitulate the system of this gas electric car, the flywheel of the engine is replaced by the field magnet part of an electric generator. There is a very deep case, bolted to the engine like a bell housing, and a second set of field magnets is located at the back of the case in line with the flywheel set but fixed and incapable of revolving. In the center of the case there is a shaft with two armatures on it, one fitting within the flywheel and the other within the stationary set of magnets. This shaft is entirely unconnected with the engine, but its rear end projects through the case and carries the usual universal joint for a propeller shaft. The engine starts when current from a small battery is turned into the coils of the forward armature, which is held from revolving by its permanent connection with the road wheels. Then, to start the car a resistance is switched in between the brushes of the flywheel generator, which thereupon starts to generate current. This current is taken to the other electric machine at the rear of the case, which it tries to drive as a motor. In this way the magnetic drag of the front end or flywheel machine and the electrical effort of the rear machine both cause the armature shaft to turn, so starting the car. The production of electricity in the flywheel machine causes the flywheel and the armature to tend to cling together and revolve at the same speed, and the amount of this magnetic grip depends upon the resistance switched into the circuit. By varying this resistance we can steadily tighten the "grip," like letting in a friction clutch, with extreme slowness and regularity. All the time the current generated is going to the rear machine and helping to drive the car. When we reach the high-gear position of the controller, however, current ceases to be sent back, since the flywheel is now only generating just enough current to maintain the grip on the armature. In this condition the car operates just like any other car on high gear, except that the engine will be making about 60 r.p.m. more than the propeller shaft. On striking a grade the difference in speed between engine and shaft will automatically increase a little, helping the car to climb without the need for moving the controller. When in high-gear position the rear machine operates as a generator and charges the battery.—*Baker-R. & L. Co., Cleveland.*

Paige

Alterations in the larger Paige Six were made late this fall and at the same time the names of the cars were

altered. The big Six which was formerly known as the Fairfield is now the Stratford, and the smaller Six which was known as the Fleetwood is now the Linwood. The wheelbase on the larger Six has been increased from 124 to 127 in. This naturally tended to lengthening the propeller shaft a distance of 4 in. In order to accommodate this increase in length and still maintain the required rigidity the drive has been broken at the center of the propeller shaft. The forward end of the shaft runs back to a massive double girder cross member of the frame wherein is mounted a large trunion bearing from which the drive is carried back to the rear axle. On this model the rear cantilever spring is now underslung and another change which has come about due to the lengthening of the wheelbase is the increase in the depth of the frame side members in order to secure the necessary beam strength, this also, of course, removing stress from the body sills and, by providing a greater rigidity throughout, guards against the development of squeaks or rattles.

In the finish and equipment of the car there have been some improvements, notably in the double cowl effect with mahogany-finished panel back of the front seats. The Collins curtains now open with the door, and in place of the gravity gasoline feed a vacuum system has been installed which has caused the gasoline tank to be taken from the cowl and placed at the rear of the chassis frame. The changes above enumerated have been made since the last announcement of the Paige company during the summer. There is also a Stewart air pump mounted on the gearbox and driven from the reverse idling pinion.—*Paige Motor Car Co., Detroit, Mich.*

Pilot

The 1917 novelty is a new L-head engine with cylinders and crankcase cast integrally. A novel process of finishing bearings by rolling them is being used and is said to be giving extremely satisfactory results. This is another of the cars having the new Delco two-unit electrical system with Delco ignition. The Pilot company was among the first in America to adopt the cantilever spring and their first cars with this equipment were very carefully thought out, the springs being almost flat and hung in accordance with the best European examples. Consequently, there has been no change in this respect. For the first time Pilot will manufacture only one model. The body has, of course, been altered and the radiator shape is changed, this part of the car now being higher and not quite so wide.—*Pilot Motor Car Co., Richmond, Ind.*

Pierce-Arrow

In common with many of the highest grade manufacturers in the world, the Pierce company very rarely makes radical changes. The three different Sixes are continued with a few detail improvements, the most obvious being the combination of the battery distributor with the generator and the change in the relative positions of the water pump and the magneto, the latter now being driven through the former, the idea being to use the water pump as a cushion to soften the intermittent torque of the magneto. Spiral bevel gears are now used in the rear axles. The pressure used in the engine lubricating system has been increased a little, but in all other particulars the powerplants are the same as before. A new process is being used for cutting the teeth on the flywheel into which the starting motor pinion engages. The Pierce flywheels have for some time been of forged steel, so the teeth are not so liable to chip as with a cast-iron wheel, but the possibility has been still more reduced by raising the carbon content of the flywheel steel and hardening the rounded edges of the teeth. This hardening is performed locally, so that it is only the tips of the teeth which are carbonized. They are quenched so as to show the hardness of about 60 or 70 on the scleroscope. Following the chassis alterations, those of the bodies are similarly not very pronounced. Each of the three cars can now be obtained with a four-passenger body.—*Pierce-Arrow Motor Car Corp., Buffalo, N. Y.*

Premier

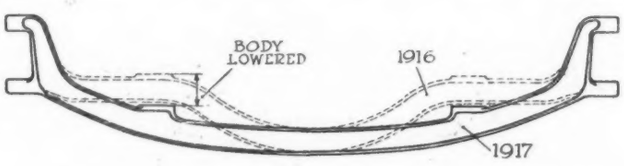
The advent of this car was anticipated with considerable interest, as it was stated when the company was reorganized that the new job would be something quite above the ordinary. In appearance it is quite a striking car and the chassis is original in a good many ways. The engine has overhead valves operated by pushrods and also an aluminum cylinder casting with which the upper half of the crankcase is combined. The frame is 8 in. deep of narrow section and the transmission, which is in unit with the engine, is provided with the Cutler-Hammer magnetic gearshift, this being controlled by buttons on the steering column. The engine has thermostat control and the water pump is combined with a fan bracket, both pump and fan being driven by a V belt from the crankshaft. All the detail work on the chassis has been carried out with extreme neatness and everywhere oil cups are used in preference to grease cups. The frame is narrow at the front and giving a wide steering lock and a tilting form of steering wheel is used, this making for easy access to the driving seat.—*Premier Motor Corp., Indianapolis, Ind.*

Reo

The Reo Four is described on page 69. Reo will continue its Six and Four of last year for the coming season. There are a number of improvements, however, in the car as compared with a year ago. On the Six there is an entirely new body with sloping windshield, an auxiliary seat which now folds into the back of the front seat; new pleated upholstery in place of the tufted, and better equipment, such as robe cords on the backs of the front seats, and a top which is rounded off in the rear, giving a limousine effect. There is also more seating room in this car, the body being 2 in. wider at the point of juncture of the windshields. Mechanically, few changes have been made. The engine has been provided with more complete methods of heating the air, and the inlet lifter mechanism has been improved so that there is a better guide alignment for the roller follower. The crankshaft diameter has been increased somewhat and now transmits the drive through the new form of Thermoid coupling which is placed between the motor and gearset. On the electric system the new Remy thermostatic regulation is used. Throughout the chassis, no changes of importance will be noted. Here and there little details have been altered, such as on the rear axle more forgings are used, particularly at the spring hangers. The Rayfield carbureter has been adopted.—*Reo Motor Car Co., Lansing, Mich.*

Roamer

It is said that a second six-cylinder car of large size will shortly be added to the smaller model, which is very little changed. This has an assembled chassis made of good quality stock parts, and the chief characteristic of the car is its lines, that of the hood and cowl being modeled to imitate as closely as possible those of the Rolls-Royce. A



Showing how the Locomobile body has been lowered without reducing ground clearance

variety of different bodies are obtainable.—*Barley Mfg. Co., Streator, Ill.*

Saxon

The Saxon Four is described on page 69. While the exterior alterations noted are the most important of the Saxon changes, there have been a number of changes mechanically which are significant. In the Six the most important alteration is the increase of the crankshaft to a diameter of 2 in. Another important change in the Six is the shifting of the carbureter from the left, or valve side, to the right side, where it attaches directly to the cylinder block, and the gas passages are cored within the casting. Heretofore, the carbureter was on the left. Similar to the Four, Wagner starting and lighting is now used on the Six. There is also a change in the ignition, the Remy distributer being used in place of the former ignition system, with the drive taken vertically off the camshaft at the center of the engine at the right side. To increase the life of the valve springs they are now made of chrome-vanadium steel, which greatly increases their resistance against fatigue. Another chassis change on the Six is the increase of the brake drum size from 11 to 12 in. A point of interest on the Saxon is that it is one of the few cars using patent rings on the pistons as stock, each piston being fitted with a Burd high compression ring at the top, below which there are two concentric rings.—*Saxon Motor Car Corp., Detroit, Mich.*

Simplex

No changes are announced in the Crane-Simplex chassis, which was announced last year. This is a large, powerful, heavily-built car on conservative lines and is sold as a chassis only. Ability to withstand extremely rough usage has been one of the main considerations in forming the design, and durability of an unusual kind is sought by the employment of an exceptional quantity of ball bearings. The Simplex is probably the only car on the American market with a ball bearing universal joint and there are few others made any where in the world.—*Simplex Automobile Co., New Brunswick, N. J.*

Studebaker

The Studebaker six has undergone similar changes to those of the four described on page 70.—*Studebaker Co. of America, Detroit, Mich.*

Sun

This car, which made its first public appearance at the 1916 shows, has several original features in engine design. The most noteworthy is that the valve gear and the valve stems are open to the interior of the crankcase, thereby receiving a plentiful supply of oil spray. Separate exhaust branches are used for each set of three cylinders, this being claimed to increase the power output. Burd piston rings are used. The transmission and the rest of the chassis are on conventional lines and are assembled from stock parts.—*Sun Motor Car Co., Elkhart, Ind.*

Velie

Almost identically the same two Sixes will be made for 1917, the principal change being that the small Six is again equipped with Timken axles. Instead of the level rod which had to be withdrawn to show the oil level, there is now a gage on the crankcase, the crankshaft is of larger diameter, and an additional ring has been added to the piston in order to minimize carbonizing. The springs have been stiffened a little. Throughout the brakework, etc., self-oiling bushings are used, and an extra amount of anti-squeak material is placed between body and chassis. Also at all junctions of sheet metal parts where rattle or squeak could develop the joints are being made more strongly; the fenders are more rigidly secured to the lamp brackets. Velie is characterized by an extreme simplicity of chassis, being among the earliest to use Hotchkiss drive and the straight tapered frame. There are a number of new body types for the small Six, several of these being of a markedly distinctive character.—*Velie Motors Corp., Moline, Ill.*

Westcott

The Westcott chassis remains practically the same as before, but the engine now has a theremostat to control the cooling water, this being mounted in the upper position against the top of the cylinder block at the front end. A Boyce Moto-Meter is also used as part of the stock equipment. A novel type of accelerator pedal which has the hinge pin placed with its center line parallel to the center line of the driver's foot. It is a wedge-shaped piece of metal and moves through a long slot which is cut transversely in the toeboard. If the driver's foot is placed firmly down upon the board toward the left hand end of the pedal the throttle will be opened only a little way, and as the foot is moved to the right, still being kept pressed firmly on the floor, the pedal will be depressed and the throttle opened further and further. This means that at no position of the throttle is it necessary for the driver to balance his foot against the spring pressure. Rather unusual care is taken in the provision of places for stowing gloves, small tools, etc., there being a special compartment for these in the cowlboard.—*Westcott Motor Car Co., Springfield, Ohio.*

Winton

Both the Winton Sixes are to be continued without any change whatever. In 1917 the Winton company will adhere to its previous policy of giving optional colors and details of finish. This latitude of choice is not confined to such things as color and upholstery material. While the main external lines of the body are standard, the proportions of the seats can be changed either front or rear, and with roadster bodies various kinds of rear boots can be fitted with the decks in different styles. Naturally it is necessary to organize a factory specialty for this class of trade, but having done so the Winton company discovered that it is possible to care for a considerable output without any difficulty. The possibility for making alterations has, of course, to be considered in the original design of the body and when this is completed a careful factory system has to be evolved whereby the special requirement can be dealt with from the body shop at a reasonable cost. Organization for repetition work can be applied efficiently to special work.—*Winton Co., Cleveland, Ohio.*

Section 3—Cars with 8 or 12-Cylinder Engines

Apperson

General details of the Apperson Six chassis are given on page 71 and that of the Eight is closely similar. To the eight-cylinder engine there have been no changes of importance, the most prominent being that the oil pressure has been increased and the bearings made a closer fit on the shaft by abandoning the use of shims, which are not easy to accommodate with a pressure-fed oil supply. As illustrating the care which manufacturers of good grade cars are now taking to eliminate spring rattle, it may be mentioned that the Apperson spring eyes are ground on the sides and the inside parts of the spring hangers are ground

to a close tolerance.—*Apperson Bros. Automobile Co., Kokomo, Ind.*

Chevrolet

The Chevrolet Eight is an entirely new car, with a valve-in-head engine with a double-cowl body, which is the last word in body style. The dimensions are 3⅜ x 4, and the overhead valves are carried in a detachable head. The cylinders are cast in two blocks, and the upper halves of the crankcase are integral. Lubrication is circulating splash with a plunger pump. Cooling is by a centrifugal water pump and honeycomb radiator. The fuel system consists of a Zenith carbureter, a vacuum system and a 20-gal. tank on the rear fitted with a gage. The starting and lighting system consists of an Auto-Lite 6-volt, double-unit outfit and a U S L storage battery, and Remy ignition is used. Valves are 1½ in. in diameter and are inclosed; connecting-rod bearings are 1½ x 1 11/16 and are bronze-backed, and crankshaft bearings are 2⅞ x 1¾, 2 x 1 31/32 and 3⅞ x 2, front to rear respectively. The cone clutch and three-speed gearbox are in unit with the engine, and the axle is a three-quarter-floating design with 4.25 to 1 gear ratio. Half-elliptic springs are used in front and cantilever in the rear.—*Chevrolet Motor Co., Flint, Mich.*

Cadillac

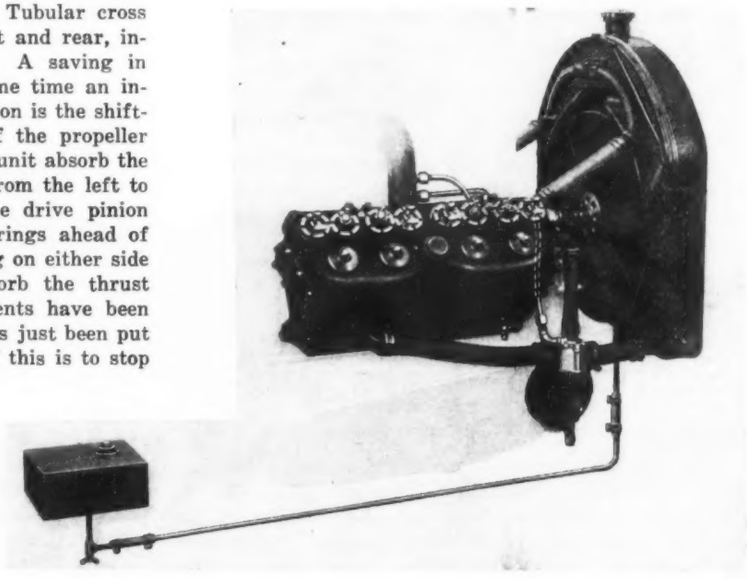
This is the third year for Cadillac eight-cylinder cars and the current model 55 shows no marked changes as compared with the previous years. The wheelbase has been increased 3 in. to 125 in., the increase being taken up in providing more body room and at the same time having the effect of making the car easier riding. The longer car has also been improved in appearance by crowned fenders and a molding around the side of the body. A new piston has been adopted this year, this being an hour-glass type instead of the straight variety, and the gain has been 1 lb. per assembly. The assembly includes two pistons and rods, so that the net saving in weight for the entire reciprocating parts of the engine is 4 lb. A refinement in the direction of accessibility has been made between the cylinder blocks, giving more space around the valves. This has been accomplished by redesigning the exhaust manifolds so that each lies 1⅛ in. closer to its cylinder block and resulting in a total increase in clearance of 2¼ in. The increase in wheelbase has necessitated a stiffening of the frame on account of the increase in bending moment. This has been amply taken care of by the use of 8-in. side member channels in place of the 6-in. channels used previously. Tubular cross members are also used now, both at the front and rear, instead of the angle sections used formerly. A saving in weight results from their use and at the same time an increase in rigidity is claimed. Another alteration is the shifting of the torque arm from the left side of the propeller shaft to the right. This is done to make the unit absorb the torque to better effect, as the engine turns from the left to the right. In the axle the mounting of the drive pinion has also been improved by placing both bearings ahead of the pinion itself instead of having one bearing on either side of it. The object of this is to better absorb the thrust stresses. A number of little detail refinements have been added to the car, the latest of these, which has just been put on this winter, is a condenser. The object of this is to stop the rapid waste of alcohol which is used as an antifreeze agent. Owing to the low boiling point of the alcohol it soon escapes as vapor. The object of the condenser is to save this and to allow it to re-enter the cooling system. Another little detail which will be appreciated by owners is the redesigning of the tail light so that it illuminates the gasoline gage on the tank at night. A splash shield now runs out horizontally at the front of the radiator and between the ends of the frame, giving better protection to the radiator than the former slanting type of guard. In the upholstery work, Cadillac is using the plaited instead of the tufted leather and the material itself is dull grained instead of the glazed. In the way of new equipment, Gabriel Snubbers have been added, and in color the Cadillac for 1917 is a deep blue instead of the dark green formerly used.—*Cadillac Motor Car Co., Detroit, Mich.*

Cole

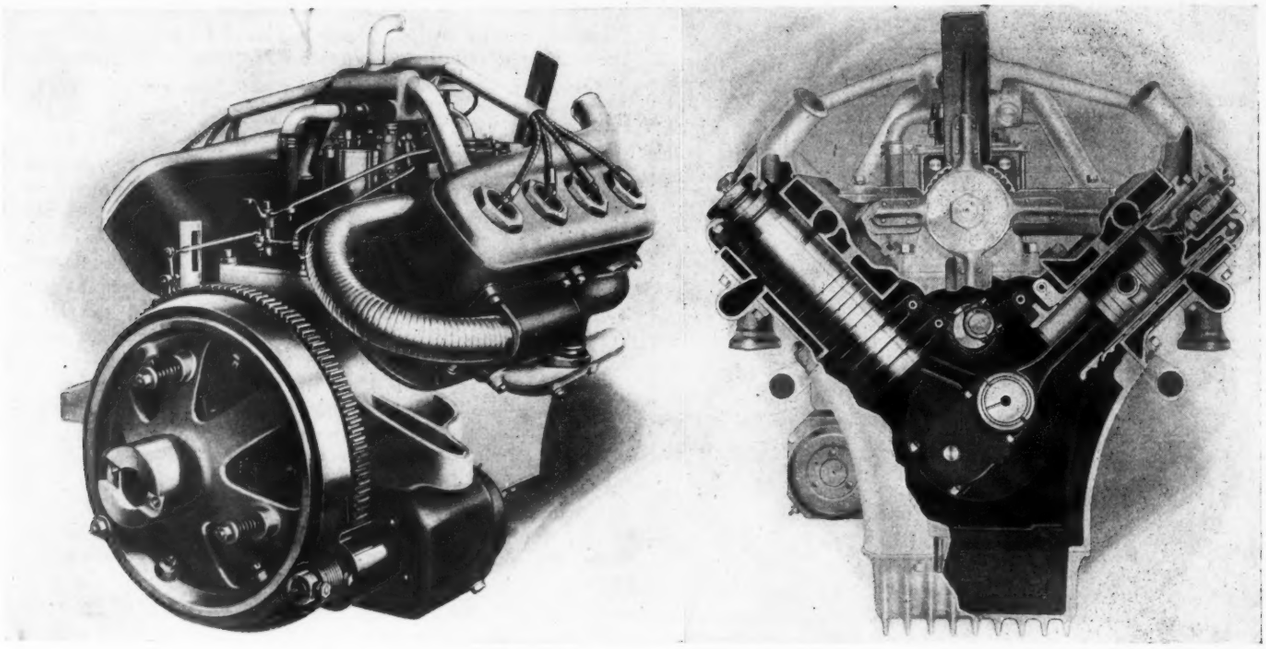
Few changes have been made in the Cole Eight, the most noticeable mechanical alterations being in the brake levers, which have new proportions, enabling the foot brake to be operated with rather less pressure. In order to eliminate torsional distortion of the rockshaft this has been made shorter, and this change in length also renders it less liable to bend, which is another way in which it can waste the braking effort. In addition, it may be remembered that Cole uses ⅜-in. pull rods, this diameter being such that they cannot possibly be stretched. Most of the refinements are to be found in the body. Storage space for tools and packages has been increased. The doors are wider and have concealed hinges and the auxiliary seats of the seven-passenger car are now made disappearing. The wheelbase is increased to 127 in. and the overhang at the rear is a little greater, this giving a total of 3 in. more leg room in the tonneau. In the four-passenger body foot room is obtained for the rear passenger by cutting away beneath the front seat. The equipment has been improved, particularly by the addition of extra tonneau and other lights.—*Cole Motor Car Co., Indianapolis, Ind.*

Cunningham

This eight-cylinder car made its first appearance at the New York show last year. It is one of the most rugged chassis on the market and the large engine is intended to operate at fairly low speed. Owing to the large size, there is plenty of room for all the engine accessories, with the re-



For use in connection with anti-freeze mixtures containing alcohol, the overflow pipe from the Cadillac radiator is taken to a condensing tank so that the costly alcohol is not wasted when the engine warms up



Sectional and general view of the new Willys-Knight eight-cylinder engine

sult that it is *really* possible to adjust the tappets without removing any of the accessories which are within the V. Only custom-built bodies are supplied.—*Jas. Cunningham Son & Co., Rochester, N. Y.*

Daniels

Produced in moderate quantities, the Daniels Eight is designed with somewhat exceptional regard to detail. In the engine very high pressure lubrication is used and the system of bearing grooving described in THE AUTOMOBILE for December 14 is employed, this having proved to be extremely satisfactory. A detail of the lubricating system is that a high oil level is maintained in the front end gearcase. This is supplied from the overflow safety valve on the end of the main oil line, and holes are arranged in the crankcase wall which separates the gearcase in the front end so that about 2 quarts of oil always remain in the gearcase before any overflow can take place back to the crankcase proper. A torque arm is used in conjunction with long underslung springs and it is well known that this sometimes produces trouble through the spring seats either seizing on the axle tubes or rusting and squeaking. To insure an ample supply of grease to this bearing a groove is cut all around it supplied with a greaser, so that on screwing down the cap grease is forced all around the whole circumference. The ordinary type of spring clips are not used. Instead, there is a platform plate beneath the spring and four nickel steel bolts.—*Daniels Motor Car Co., Reading, Pa.*

Enger

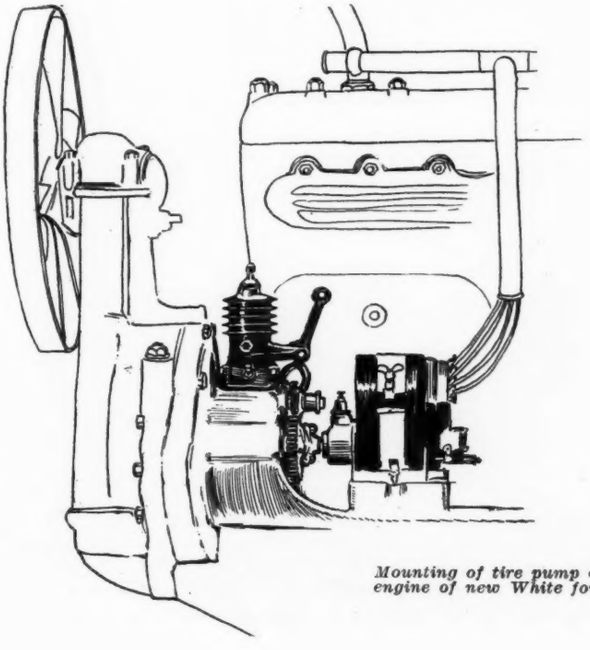
The feature of the Enger Twelve is a special form of control which allows it to be operated either on all twelve cylinders or on one of the rows of six only. The valves are placed overhead and a shaft is mounted above the left cylinder block bearing cams which will press down and hold open all the exhaust valves on that side when rotated by a lever on the steering column. Simultaneously a special butterfly throttle is firmly closed in the intake leading to the left side of the engine, whereupon the six left-hand cylinders, instead of drawing in and firing charges, merely oscillate a little insert gas through the exhaust manifold. This is the least costly of all twelve-cylinder cars and is produced in only one style, that being as a five-passenger touring car.—*Enger Motor Car Co., Cincinnati, Ohio.*

Hal

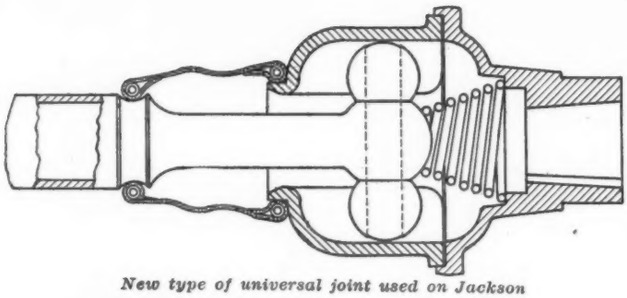
The Hal Twelve, first introduced at the New York show in 1916, is unchanged in specifications. The Weidely overhead valve engine is used, this being distinguished by the possession of four blocks of three cylinders. It is one of the cleanest of V engines, nothing but the carbureter being located within the V. It is a large car with a very high and narrow radiator and possesses an extremely distinctive appearance, both as a seven-passenger car and as a roadster.—*Hal Motor Car Co., Cleveland, Ohio.*

Haynes

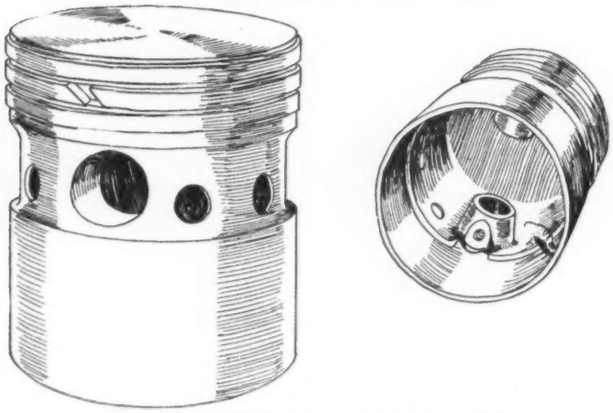
Although it appeared at the last New York show, the



Mounting of tire pump on engine of new White four



New type of universal joint used on Jackson



The drilled piston used in the 1917 Cadillacs

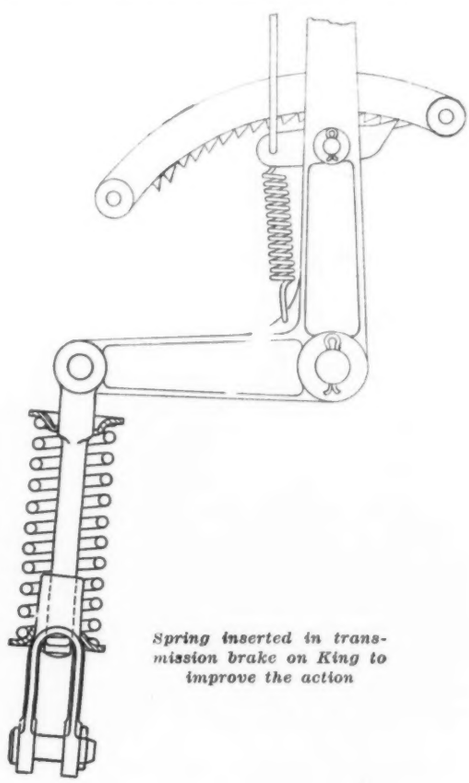
Haynes twelve-cylinder model has only recently been coming through the factory in quantities; the chassis is identical with that employed for the six-cylinder (see page 74). The Twelve is an overhead valve engine with detachable cylinder heads, but the cylinders themselves are cast in threes instead of sixes, although there are only two hub blocks. Aluminum pistons of the hour-glass form are used, each with three patented rings. The two exhaust pipes come on the outside of the engine and the accessories are arranged in a very accessible manner, the double Delco distributor being at the rear end of the V and the carbureter in the center, with all other fittings on the sides of the crankcase. There is a complete pressure oiling system.—*Haynes Automobile Co., Kokomo, Ind.*

Jackson

Changes in the Jackson line during the year consist in the addition of an eight-cylinder car with a valve-in-head engine. The only difference between this car and other Jacksons is in the powerplant, as the specifications of the new model include all the features of the others, such as full elliptic springs front and rear, Zenith duplex carbureter, Stewart vacuum feed, Auto-Lite starting and lighting and Remy ignition. This new Eight leads the Jackson line for 1917. Some of the features of the new powerplant, which, as stated, is the only really new development, are the combined intake manifold and water outlet header, the belt-driven generator, and the Borg & Beck clutch which is combined with the engine. In the combination manifold the water outlet acts as a hot jacket for the intake, and the manifold is arched with the carbureter suspended from the center, so that condensation cannot settle in the manifold but must run to one cylinder block or the other. A feature of the design is that, although the valve-in-head construction is used, the valves are completely inclosed, yet they may be adjusted or the rockers may be oiled without removing the covers. This is due to the peculiar valve construction. The rocker is a steel pressing and has a cup at its center which fits over a ball-ended stud mounted in the head, which is adjustable from the outside, and by moving it in or out the proper clearance between the rocker and the valve may be obtained. The ball joint is oiled by a wick which is placed in a hole drilled in the center of the stud.—*Jackson Motor Car Co., Jackson, Mich.*

King

The King Eight has been continued with refinements. Mechanically there are no changes which rank as important or radical. The brakes have been improved, there is a new gasoline system, the Stewart vacuum, the radiator is larger and better shaped, the tie rod yoke has been redesigned and there are one or two small alterations in the crankshaft. The brake changes affect both the service and the hand brake, the latter being mounted as in previous King models on the end of the transmission shaft. The change is the insertion of a spring link in the line, so that any desired tension can be placed upon the brake linkage, thus tightening the brake as firmly as desired and allowing the car to be left safely upon any gradient without danger of rolling. On tightening the brake it is possible to set the brake as it would be with the ordinary type of linkage, and then, upon further pull on the hand lever, the brake can be tightened four more notches on the brake quadrant. On the foot brake the change is in the insertion of an equalizing mechanism at the rear; it was formerly solid from the pedal all the way back to the brake levers on the rear axle. On the engine there have been two slight alterations in the crankshaft. These are in the increase of the thrust flange area at the center bearing and in the use of a crab for holding the valve tappet guide in place. The shaft has a diameter of 1 13/16 at the center bearing and the flange originally had a diameter of 2⅝ in. The diameter is now 3½ in. This about doubles the area of the thrust surface on the center bearing. This is a three-bearing shaft with side by side connecting-rods. The use of the crab instead of the plate formerly used has the advantage of not tending to bind the guide for the tappet. Another change, which is rather part of the oiling system than of the crankshaft, is the installation of an oil throw-off at the rear bearing. This is in the form of two grooves, and after the oil is thrown from the shaft it drains back to the crankcase and joins the other circulating oil. There are no other changes in the oiling system. One of the alterations of detail which represents a valuable addition to the safety of the car is in the connection of the tie rod end to the steering arm. This is now a forked yoke connection with a bearing both above and below. In addition to the larger bearing space provided, the yoke connection is better connected to the cross arm by means of two clamp bolts instead of one. A minor detail which

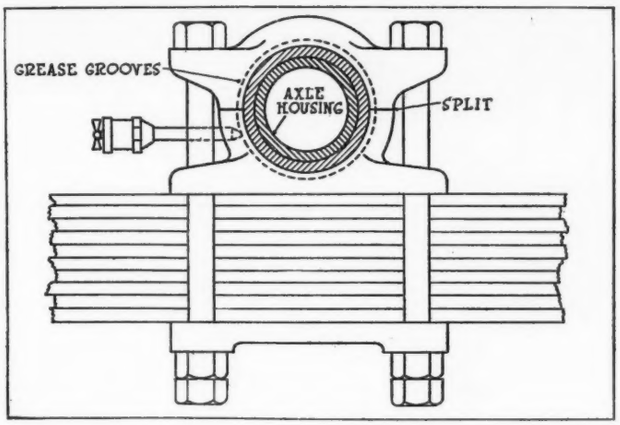


Spring inserted in transmission brake on King to improve the action

is illustrative of the care taken to prevent rattles is in the use of a full length steering column sleeve, which now extends from the wheel to the steering gear housing, whereas it formerly only went down as far as the dash.—*King Motor Car Co., Detroit, Mich.*

Oldsmobile

Changes have been made in almost every important detail of the Oldsmobile eight, so that the model 45 is practically a new design. The present car is 20 per cent more powerful than the product of a year ago. The engine has been considerably improved; the electrical equipment has been overhauled and remounted; a better oiling system is installed; the drive units have been changed; the spring suspension bettered; the tires increased, and the spark plugs relocated. Improvements in the power plant have resulted in the production of 56 hp. at 3200 r.p.m., whereas with the former car, 45 was secured at 2800 r.p.m. This increase in power is largely due to the redesigned manifolds and the better cam shape which gives a quicker lift to the valves with a longer open period. The redesigned manifolds give smoother gas flow and they are now cast separately whereas they were integral. The intake header is now hot-water jacketed, and the exhaust instead of being a cross pipe between the blocks is a Y-shaped piece with the branches of the Y coming together under the floor boards. In refining the motor three studs have been added to the detachable head and it has a greater water carrying capacity. With the three studs there is no tendency to distort the valve seat on tightening them. Lynite pistons are still used but they are now drilled in the lower edge of the bottom ring groove and also in the upper edge of this groove, with two holes at points 90 degrees around from the wrist pins in addition. The lower edges of the three ring grooves are chamfered. The connecting rods on the new model are now machined all over and the new crankshaft is made of chrome nickel steel with three counter-weights, electrically welded in place. Oiling is now by pressure to the timing gears, a pipe off the main lead terminating at the mesh point of the gears and putting a $^3/_{16}$ in. stream at this point. One of the most radical changes on the new Oldsmobile is the mounting of the generator and fan on the same shaft. The two are assembled together, whereas the fan was formerly alone with a floating drive. The new assembly is driven by a ¾ x ⅜ V-belt with riveted lugs, the reduction between the crankshaft and fanshaft is 1½ to 1. The use of a new round top radiator together with the large cylinder head, has resulted in an increase in the cooling capacity. This is now 5 gal. in place of 4½ gal. Elsewhere the cooling system is the same except for an improved pump drive through clips which are designed to shear in case the pump is frozen. Formerly there was rigid drive. There is also an all-rubber hose connection between the radiator and engine instead of the metal elbow. The same clutch and gearbox is employed but there have been changes in the rear axle. The ratio is now $4^{11}/_{12}$ to 1 in place of $4^5/_{12}$, and a truss rod has been added beneath the axle with a turn buckle adjustment. The front springs have been flattened slightly and the steering cross arm is now higher, bringing it directly behind the front axle. Electrically, the car is the same, except that the spark plugs have been moved over so that they are now above the intake valves.—*Olds Motor Works, Lansing, Mich.*

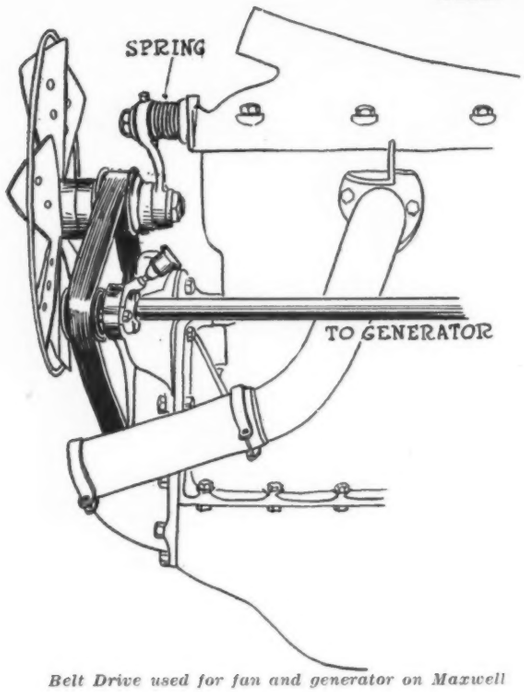


Provision for lubrication all around spring seat on Daniels eight

Rear view of new Pathfinder body with compartments for two spare wheels. This is on a seven-passenger car and similar provision is made on the roadster models. This is the first stock car to have spare wheels completely concealed and protected from collisions and the effect of the weather

Packard

Although the twelve-cylinder Packard 1917 model is essentially the same as that of the previous year, there have been several detail changes, of which probably the most interesting is the use of a new type of manifold. The manifold is in three parts, each cylinder block has a longitudinal passage which is used to connect all six valves. There is now a partition at the center so that the valves in each set of cylinders are divided into two sets of three each. The transverse pipe which connects the two cylinder blocks is also provided with a partition which mates with the partitions in the cylinder passages. This is equivalent to using separate intake systems for the three front cylinders of each block, and the three rear cylinders thereof. The order of firing is 1, 4, 2, 6, 3, 5, so that one of the front three and one of the rear three have alternate suction strokes. For the suction on any one of the front three valves to effect that in the back three, it would have to travel all the way up the side of the partition to the carbureter and then back down the other branch. It has been found that this new intake layout has entirely prevented loading of any cylinder. Another change which makes for accessibility, and has manufacturing advantages, is the substitution of detachable cylinder heads for the integral pattern, and a change in the position of the thermostat, which is now located at the top of the system in the cylinder outlet instead of at the bottom. The reason for this is that the top position allows the thermostat to control the maximum temperature prevailing in the engine, whereas the lower position controls the minimum. With the upper position, the engine will come up to proper working temperature more quickly and the control provided by the thermostat is said to be more delicate when it operates in the hotter water. Another change on the engine has been in the mounting of the adjustable pinion which tensions the front end chain. To set this, a plug in the top of the front end is removed, this allowing the tension of the chain to be felt. By disconnecting a lock-



Belt Drive used for fan and generator on Maxwell

ing device, the chain can then be adjusted and locked again without removing any parts. A much harder alloy with a smaller coefficient of expansion is now being used for the pistons, which are, consequently, made a closer fit in the cylinders. The rest of the car is unaltered except for a decrease in the height of the frame which has been brought some 2 in. nearer the ground, giving the car a much lower appearance.—*Packard Motor Car Co., Detroit, Mich.*

Oakland

The Oakland eight is changed in no particular. There is also a six-cylinder Oakland described on page 77.—*Oakland Motor Car Co., Pontiac, Mich.*

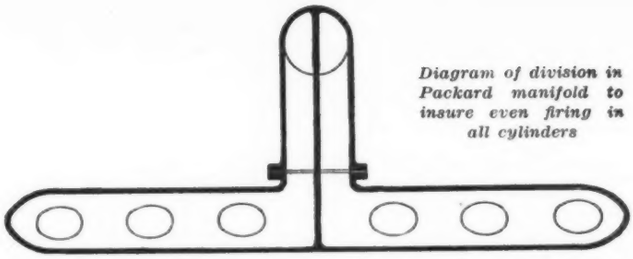


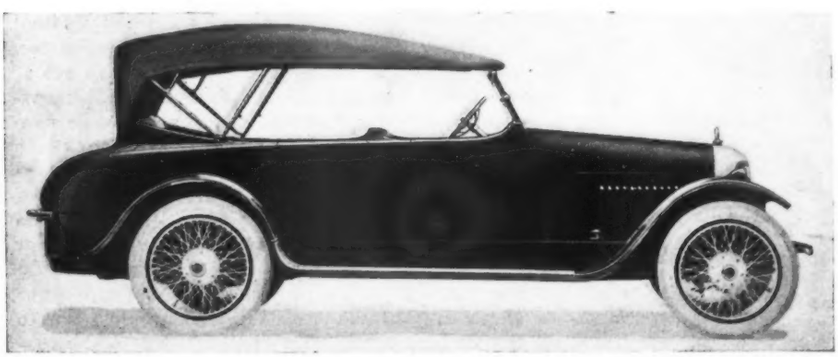
Diagram of division in Packard manifold to insure even firing in all cylinders

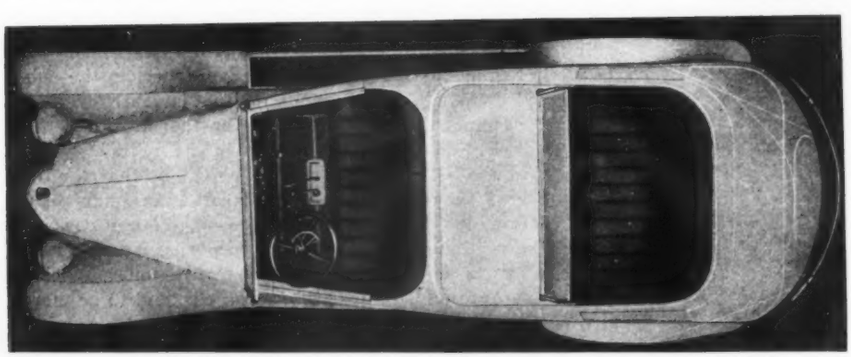
Peerless

There are practically no changes in the Peerless eight, new a year ago. An ingenious detail would attract attention quite apart from the general fine engineering and good finish associated with the name. This is an attachment to the handle of the level cock which shows the oil level in the crankcase and is so arranged that when the cock is open the hood cannot be closed. Thus should a driver forget to close the level gage the fact will be brought to his attention before he starts the car. In order to get light clutch action there is a double leverage arrangement near the bottom of the clutch pedal. The pedal pads are pivoted and held against rattle by small springs.—*Peerless Motor Car Co., Cleveland, Ohio.*

Pathfinder

The Pathfinder twelve is the first stock car to be equipped with a body in which the spare wheels or tires can be stowed away in a compartment arranged beneath the back of the frame. This is undoubtedly the best place to keep such spares, but previously, it has always seemed impossible to find the space. The Pathfinder engineers have somehow discovered the answer. Of course, this gives the car an entirely new rear end appearance, although this has none of the clumsiness which might be anticipated. Not only does the body contain two spare wheels but it also conceals the top. The same system is applied to both seven-passenger and smaller capacity bodies. On the new four-passenger roadster there is a cowl of great depth which can be lifted up, and this carries a windshield which thus comes close in front of the rear passengers. The cowl protects them from draft, making the rear seat practically as snug as an inclosed car. It is to be noted that the disposition of the wheels lowers the center of gravity of the car. In order to suit this design the frame is entirely new, of a very deep thin section. The power plant and the running gear are practically the same as last year.—*Pathfinder Company, Indianapolis, Ind.*





Above—Seven-seated Pathfinder with body having compartments at the rear for two spare wheels and for containing the top when folded. Below—Plan of Pathfinder four-passenger with deep rear cowl and rear windshield

National

The six-cylinder National is mentioned on page 77. The twelve has had a number of modifications introduced in the engine. It will be remembered that this has two camshafts with the valves placed on the outside, this leaving the V clear for the accessories. The engine is set fairly

(*Continued on page* 100)

Program of Show-Week Activities

Details of Engineering Sessions, Business Meetings, Show Features, Dealers' Conventions and Numerous Social Functions

Seventeenth Annual National Automobile Show, Grand Central Palace, Jan. 6-13. Opens Saturday at 2 p. m. and closes at 10.30 p. m. Opens thereafter at 10 a. m. and closes at 10.30 p. m.

S. A. E. Program

Monday, Jan. 8—S. A. E. Office, 29 West Thirty-ninth Street, 10 a. m. Meeting of Aeronautic Engine Division.

Tuesday, Jan. 9—S. A. E. Office, 29 West Thirty-ninth Street, 10 a. m.
Engine and Transmission Division.
Ball and Roller Bearings Division.
Tire and Rim Division.
Research Division.
Springs Division.

2 p. m.

Electric Vehicle Division.

Wednesday, Jan. 10—S. A. E. Office, 29 West Thirty-ninth Street, 9.30 a. m. Standards Committee Meeting.

Thursday, Jan. 11—Engineering Societies Building, 29 West Thirty-ninth Street.
Business Session, 10 a. m.
Election of Officers.
Committee Reports.
Constitutional Amendment.
Report from Standards Committee.
Treasurer's Report.

1 to 4.30 p. m.

Professional Session.

1.30 p. m.—*Some Problems in Airplane Construction*—Capt. V. E. Clark Capt. T. F. Dodd, and O. E. Strahlmann. (The authors outline the military functions, general specifications and problems involved in the construction of army airplanes and make suggestions for improvements in their design.)

2.30 p. m.—*The Ultimate Type of Tractor Engine*—H. L. Horning. (Mr. Horning has made a thorough study of the application of engines to tractors. His suggestions relating to the ultimate tractor engine will treat of methods of obtaining higher efficiencies and of making use of kerosene and other low-grade fuels. He will probably go into details regarding the specifications representing good practice of design and material for such engines.)

3.30 p. m.—*Dynamic Balancing of Rotating Parts*—F. Hymans. (Mr. Hymans' paper first shows the considerations necessary in securing dynamic balance and then explains types of machines for doing such work.)

TO BE PRESENTED IF TIME PERMITS

Remarks on Dynamics of the Automobile—N. W. Akimoff. (The main part of Mr. Akimoff's paper is devoted to an analysis of a one wheel elementary car. This analysis is used to deduce the requirements in design necessary for a rational automobile suspension.)

Some Essential Features of High-Speed Engines—A. F. Milbrath. (Mr. Milbrath's paper gives considerable data that are the result of several years' experimental work in manufacturing high-speed engines. The various parts of the engine are taken up and the best construction and dimensions are indicated.)

Heat Balance Tests of Automobile Engines—Walter T. Fishleigh and Walter E. Lay. (This paper gives the result of some valuable research work conducted by the authors at the University of Michigan. Data are included relating to the distribution of the heat of the fuel in power, friction, jacket-water and exhaust losses.)

Aerial Navigation Over Water—Elmer A. Sperry. (Ordinary flight over land is usually made with landmarks. In flight over the sea devoid of landmarks other means must be employed. Mr. Sperry discusses fully such means and their use, including the troublesome matter of drift and absolute headway.)

7.30 p. m.—Annual Banquet, Grand Ballroom, Hotel Biltmore.

Midnight—Special performance Ziegfeld's Midnight Frolic.

N. A. C. C.

Tuesday, Jan. 9—Annual banquet, 7 p. m., Waldorf-Astoria.

Wednesday, Jan. 10—Directors' meeting, 10 a. m., at headquarters, 7 East Forty-second Street.

Friday, Jan. 12—All day session of export managers' meeting.

M. & A. M.

Wednesday, Jan. 10—9.30 a. m., at 22 West Forty-second Street.
Executive Committee meeting.
Banquet Committee meeting.
10 a. m., Finance Committee meeting.
11 a. m., Board of Directors' meeting.
3 p. m., Thirteenth annual meeting at the Waldorf-Astoria.
7.30 p. m., Ninth annual banquet at the Waldorf-Astoria.

Thursday, Jan. 11—Board of Directors' meeting at 22 West Forty-second Street, 2.30 p. m.

Social and Business

Jan. 3, 4 and 5—Rex Ignition Mfg. Co., annual salesmen's convention, including theater party for evening of Jan. 5.

Jan. 5—Hill Insulating & Mfg. Corp.—Dinner, Hotel Manhattan.

Jan. 5—Olds Motor Works—Banquet, Reisenweber's.

Jan. 5—Olds Motor Works—Morning and afternoon, Dealers' Convention at salesroom.

Jan. 6—Saxon Motor Car Corp.—Luncheon, Biltmore.

Jan. 9—Velie Motor Vehicle Co.—Morning meeting, Claridge.

Jan. 9—Holt-Welles Co.—Meeting at offices, 1790 Broadway.

Jan. 9—Dodge Bros.—Luncheon, Crystal Room, Ritz-Carlton.

Jan. 10—Mitchell Motors Co.—Noon meeting for dealers, Biltmore.

Jan. 10—Mercer Automobile Co.—Dealers' meeting, Hotel Astor.

Jan. 10—Velie Motor Vehicle Co.—Morning meeting, Claridge.

Jan. 10-11—Master Carbureter Corp.—Dealer convention at Park Avenue Hotel.

Jan. 11—Paige-Detroit Motor Car Co.—Banquet, Reisenweber's Cafe.

Jan. 11—Pierce-Arrow Motor Car Co.—Luncheon, Biltmore.

Jan. 11—Holt-Welles Co.—Meeting at offices, 1790 Broadway.

Jan. 11—Hupp Motor Car Corp.—Luncheon for dealers, Biltmore.

Jan. 13—Emil Grossman Mfg. Co.—Meeting of sales staff, Hotel Astor.

1917 Passenger Automobiles Listed

Listing 131 Makes of American Cars and 188 Chassis Models—Full

FOLLOWING its annual custom, THE AUTOMOBILE publishes herewith its table of specifications to serve as a reference for the 1917 models. The information from which these tables are derived is authentic data furnished by the manufacturers themselves upon specification sheets especially adapted for the purpose. These sheets are filled out and signed by a member of the concern making the car, thereby rendering the information supplied accurate and as complete as possible. There are a few makers whose names do not appear in the list and where this occurs it is because the 1917 models have not as yet been announced and will not be until after the opening of the New York Show. In other instances models are announced in these tabulations for the first time.

In addition to the information given in the tabulations a review of the field is given in the descriptions published on pages 61 to 84 of this issue, together with the particulars of a few cars announced too late for inclusion in the tables. For those to whom the price is of particular importance a buyer's guide will be found with cars listed under price classifications on pages 29 to 60.

Tabulations on this and succeeding pages include the names of 131 different manufacturers and a total

MAKE AND MODEL	No. of Cylinders	Bore and Stroke Inches	Piston Displacement; Cubic Inches	Gear Ratio on Direct	Make of Engine	Cylinder Shape	Cam-shaft Drive	Water Circu-lation	LUBRICATION		ELECTRIC SYSTEM		IGNITION			CARBURETION	
									System	Type of Pump	Generator Make	Voltage	System	Make	Control	Make of Carbureter	Fuel Feed
Abbott.....6-44	6	3½x4½	224.0	4.75-1	Continent..	L	Helical	Cent	Splash-Pres	Piston	Remy	6	Single	Remy	Hand	Stromberg	Vacuum
Aland.....14-60	4	3 x5½	155.5	4.33-1	Own	I	Bevel	Ther	Pressure	Gear	U.S.L	12	Single	Eisemann	Hand	Zenith	Vacuum
Allen.....Classic	4	3½x5	220.9	4.00-1	Own	L	Helical	Ther	Circ-Spl	Piston	Westinghouse	6	Single	Westinghouse	Hand	Stromberg	Vacuum
American.....A	6	3 x5	212.0	4.42-1	Ameo	L	Helical	Cent	Circ-Spl	Piston	G&D	6	Single	G&D	Hand	Zenith	Carter
Ams-Sterling	4	3½x4½	138.1	4.25-1	LeRoi	L	Helical	Ther	Splash-Pres	Piston	Bosch	12	Single	Bosch	Hand	Stromberg	Gravity
Anderson.....6-40	6	3½x4½	224.0	4.42-1	Continent..	L	Helical	Cent	Splash-Pres	Piston	Westinghouse	6	Single	Westinghouse	Hand	Own	Gravity
Appersen Roadaplane...6-17	6	3½x5	288.6	4.25-1	Own	L	Helical	Cent	Pressure	Gear	Bijur	6	Dual	Remy	Hand	Rayfield	Vacuum
Appersen Roadaplane...8-17	8	3½x5	306.8	4.64-1	Own	L	Helical	Ther	Pressure	Gear	Bijur	6	Dual	Remy	Hand	Rayfield	Vacuum
Arbenz.....25	4	3½x5	165.9	4.25-1	Lycoming..	L	Helical	Ther	Splash	Piston	Apleo	6	Single	Apleo	Hand	Carter	Gravity
Auburn.....6-39	6	3½x5	230.1	4.42-1	Tector	L	Helical	Cent	Circ-Spl	Piston	Remy	6	Single	Remy	Hand	Rayfield	Vacuum
Auburn.....6-44	6	3½x5½	303.1	4.00-1	Continent..	L	Helical	Cent	Circ-Spl	Piston	Delco	6	Single	Delco	H&A	Rayfield	Vacuum
Austin Highway King	12	2½x5	389.5	3.75-1	Weidely	I	Helical	Cent	Pressure	Gear	Delco	6	Single	Delco	Hand	Stromberg	Vacuum
Bell.....17	4	3½x5	192.4	4.25-1	Lycoming..	L	Helical	Ther	Circ-Spl	Piston	G&D	6	Single	At Kent	Hand	Carter	Vacuum
Biddle.....D	4	3½x5½	226.4	4.00-1	Special	L	Helical	Ther	Circ-Spl	Gear	G&D	6	Single		Hand	Zenith	Vacuum
Bour-Davis	6	3½x4½	224.0	4.42-1	Continent..	L	Spur	Cent	Splash-Pres	Piston	G&D	6	Single	G&D	Hand	Stromberg	Vacuum
Brewster-Knight	4	4 x5½	276.5	4.50-1	Own	I	Chain	Cent	Pressure	Gear	U.S.L	12	Single	Bosch	Hand	Zenith	Vacuum
Briscoe.....BA-24	4	3 7/16x5½	163.5	4.23-1	Own	L	Helical	Ther	Circ-Spl	Piston	Splitdorf	6	Single	Conn	Hand		Gravity
Buick.....D-34, D-35	4	3½x4½	170.0	4.08-1	Own	I	Helical	Cent	Circ-Spl	Piston	Delco	6	Single	Delco	Hand	Marvel	Vacuum
Buick D-44, D-45, D-46, D-47	6	3½x4½	224.0	4.08-1	Own	I	Helical	Cent	Circ-Spl	Gear	Delco	6	Single	Delco	H&A	Marvel	Vacuum
Cadillac.....55	8	3½x5½	314.4	4.37-1	Own	L	Chain	Cent	Pressure	Gear	Delco	6	Single	Delco	Atmtc	Own	Pressure
Cameron	6	3 x5	212.0	4.00-1	Ameo	L	Helical	Cent	Splash-Pres	Piston	G&D	6	Single	G&D	Hand	Zenith	Vacuum
Case.....T-17	4	3½x6	247.7	4.40-1	Own	L	Helical	Ther	Pressure	Piston	Auto-Lite	6	Single	Conn	Hand	Rayfield	Gravity
Chalmers.....6-30	6	3½x4½	224.0	4.75-1	Own	L	Helical	Ther	Splash-Pres	Gear	Westinghouse	6	Single	Remy	Hand	Stromberg	Vacuum
Chalmers.....6-30	6	3½x4½	224.0	5.18-1	Own	L	Helical	Ther	Splash-Pres	Gear	Westinghouse	6	Single	Remy	Hand	Stromberg	Vacuum
Chandler.....17	6	3½x5	268.4	3.40-1	Own	I	Chain	Cent	Circ-Spl	Piston	G&D	6	Single	Bosch	Hand	Rayfield	Vacuum
Charter Oak.....A	6	4 x5½	414.7	3.77-1	Hersh-Sp	T	Spur	Cent	Pressure	Gear	Westinghouse	6	Double	Bosch	Hand	Rayfield	Gravity
Chevrolet.....490	4	3½x4	170.9	3.67-1	Own	I	Helical	Ther	Splash-Pres	Piston	Auto-Lite	6	Single	Conn	Hand	Zenith	Gravity
Chevrolet.....F-5, F-2	4	3½x4	17 .9	4.25-1	Own	I	Helical	Ther	Splash-Pres	Piston	Auto-Lite	6	Single	Conn	Hand	Zenith	Vacuum
Chevrolet.....D	8	3½x4	286.3	4.25-1	Own	I	Helical	Cent	Circ-Spl	Piston	Auto-Lite	6	Single	Conn	Hand		Vacuum
Cole.....8-60	8	3½x4½	346.3	4.45-1	Northway	L	Spur	Cent	Pressure	Gear	Delco	6	Double	Delco	H&A	Stromberg	Vacuum
Crow-Elkhart.....CE-35	4	3½x5	192.4	4.25-1	Lycoming..	L	Helical	Ther	Circ-Spl	Piston	Dyneto	6	Single	Conn	Hand	Zenith	Gravity

ABBREVIATIONS:—**Make of Engine:** Continental, Continent; Herschell-Spillman, Hersh-Sp; Golden, Belknap & Swartz, G.B.&S.; Massnick-Phipps, Mass-Ph. **Cylinder Shape:** L-Head, L; I-Head, I; T-Head, T. **Camshaft Drive:** Spur Gears, Spur. **Water Circulation:** Centrifugal, Cent; Thermo-syphon, Ther. **Lubrication System:** Splash-Pressure, Splash-Pres; Circulating-Splash, Circ-Spl. **Oil Pump Type:** Impeller, Imp. **Electric System:** Ward Leonard, Ward-L; Gray & Davis, G & D; Allis-Chalmers, Allis-Ch; Leece-Neville, Leece-N. **Ignition System:** Dual-Double, Dual-D. **Ignition Make:** At-water Kent, At Kent. **Ignition Control:** Hand and Automatic, H&A; Automatic, Atmtc. **Make of Carbureter:** Reichenbach, Reichbch; Longuemare, Longmare. **Clutch Type:** Multiple Disk, Mul-D. **Gearset Type:** Selective, Sel; Planetary, Plan; Friction, Fric. **Gearset Location:** Unit with Motor, Unit M; Unit with Axle, Unit X; Amidship, Amid; Unit with Torque Tube, Unit T. **Final Drive:** Spiral

with Their Technical Specifications

Details of Power Plant, Transmission System and Running Gear

of 188 different chassis models. These are listed alphabetically, and in every case are the models that the manufacturers named are placing on the market for the 1917 season.

The arrangement of the tables follow through the chassis in logical order. The power plant is first considered, and under this broad head the number of cylinders, the bore and stroke dimensions, horsepower, displacement, cylinder shape, make of engine, details of the valve location, camshaft drive, cooling, lubrication, ignition, carburetion and electrical equipment are furnished.

In giving the bore and stroke of the engine the fractions of an inch are supplied in decimals carried accurately to three places. Since practically all the manufacturers in this country have motors with dimensions which do not run to smaller fractions than eighths of an inch, this decimal system gives the measurements with absolute accuracy.

Two cars not included in the specifications are the Doble and the Stanley, since, being steam cars, their specifications do not fit in with those of gasoline vehicles. These cars are briefly described on page 64 and illustrated on page 63. Electric cars are not covered in this issue but will be illustrated and their specifications will be reviewed later.

TRANSMISSION								RUNNING GEAR							BEARINGS			
	GEARSET								TIRES									
Clutch Type	Type	Location	Forward Sp'ds	Final Drive	Car Drives Through	Rear Axle Type	Make of Rear Axle	Torque Taken By	Wheelbase	Front	Rear	Wheels	Rear Springs	Make of Speedometer	Crankshaft Bearings Number	Gearset	Rear Axle	Front Wheel	MAKE AND MODEL
Plate	Sel	Unit M.	3	Sp.B.	Springs.	¾ Float	Salisbury	Springs.	122	32x4	32x4	Wood	S-E	Stewart	Plain. 3	Ball	Roll.	Roll.	Abbott-6-44
Disk	Sel	Unit M.	3	Sp.B.	Springs.	Semi-F	Timken	Springs.	122	33x4	33x4	Wire	S-E	VanSicklen	Plain. 3	Ball	Roll.	Ball.	Aland-14-63
Cone	Sel	Unit M.	3	Bevel	Springs.	Float	Adams	Tor.T	112	32x3½	32x3½	Wood	S-E	Stewart	Plain. 2	B&P	Ball.	Ball.	Allen-Classic
Plate	Sel	Unit M.	3	Sp.B.	Springs.	¾ Float	Salisbury	Springs.	122	32x4	32x4	Wood	S-E	VanSicklen	Plain. 3	B&P	B&R.	Ball.	American-A
Plate	Sel	Unit M.	3	Bevel	Springs.	Semi-F	Special	Springs.	110	30x3½	30x3½	Wood	S-E	Warner	Plain. ...	Roll	Roll.	Ball.	Ams-Sterling
Plate	Sel	Unit M.	3	Bevel	Springs.	Semi-F	Mott	Springs.	120	33x4	33x4	Wood	S-E	Stewart	Plain. 3	Ball	Ball.	Ball.	Anderson-6-40
Plate	Sel	Amid	.....	Sp.B.	Springs.	Float	Own	Springs.	130	34x4	34x4	Wood	¾ Ell	VanSicklen	Plain. 4	Roll	Roll.	Roll.	Apperson Roadaplane-6-17
Plate	Sel	Amid	3	Sp.B.	Springs.	Float	Own	Springs.	130	35x4½	35x4½	Wood	¾ Ell	VanSicklen	Plain. 3	Roll	Roll.	Roll.	Apperson Roadaplane-8-17
Cone	Sel	Unit M.	3	Bevel	Springs.	Float	Gemco	.....	108	30x3½	30x3½	Wood	Cant	Carter	Plain. 2	Ball	Roll.	Ball.	Arbenz-25
Plate	Sel	Unit M.	3	Sp.B.	Springs.	¾ Float	Columbia	Tor.T	120	34x4	34x4	Wood	S-E	.....	Plain. 3	B&P	Roll.	Ball.	Auburn-6-39
Plate	Sel	Unit M.	.....	Sp.B.	Springs.	¾ Float	Columbia	Tor.T	131	35x4½	35x4½	Wood	Cant	.....	Plain. 3	Ball	Roll.	Ball.	Auburn-6-44
Disk	Sel	Unit M.	6	Sp.B.	Springs.	Float	Own	Springs.	142½	34x4½	34x4½	Wood*	Cant	Warner	Plain. 4	Ball	B&R.	Roll.	Austin Highway King
Disk	Sel	Unit M.	3	Bevel	Springs.	¾ Float	Adams	Springs.	112	31x4	31x4	Wood	¾ Ell	Stewart	Plain. 2	Roll	Roll.	Ball.	Bell-17
Plate	Sel	Unit M.	4	Bevel	Springs.	¾ Float	Special	Springs.	122	32x4	32x4	Wire	¾ Ell	Warner	Plain. 3	Ball	B&R.	Ball.	Biddle-D
Plate	Sel	Unit M.	3	Sp.B.	Springs.	¾ Float	Salisbury	Springs.	118	32x4	32x4	Opt	S-E	Warner	Plain. 3	B&P	B&R.	Ball.	Bour-Davis
Cone	Sel	Unit-T.	3	Sp.B.	Tor.T.	Float	Own	Tor.T	125	34x4½	34x4½	Wood	Cant	Stewart	Plain. 3	Ball	Ball.	Roll.	Brewster-Knight
Cone	Sel	Unit X.	3	Bevel	Springs.	Semi-F	Own	Tor.R	105	30x3½	30x3½	Wood	Ell	Stewart	Plain. 2	BR&P	B&R.	Ball.	Briscoe-BA-24
Cone	Sel	Unit M.	3	Bevel	Springs.	¾ Float	West.M	Tor.T	106	31x4	31x4	Wood	S-E	Stewart	Plain. 3	B&R.	B&R.	Ball.	Buick-D-34, D-35
Cone	Sel	Unit M.	3	Sp.B.	Tor.T.	Float	West.M	Tor.T	115	34x4	34x4	Wood	Cant	Stewart	Plain. 4	Ball	B&R.	Ball.	Buick-D-44, D-45, D-46, D-47
Disk	Sel	Unit M.	3	Sp.B.	Springs.	Float	Timken	Tor.M	125	36x4½	36x4½	Wood	Plat	Warner	Plain. 3	Ball	Roll.	Roll.	Cadillac-55
Plate	Sel	Unit X.	3	Sp.B.	Rad.Rd.	¾ Float	Own	Tor.T	122	32x4	32x4	Wire	Cant	.....	Plain. 3	Ball	Ball.	Ball.	Cameron
Cone	Sel	Unit M.	3	Sp.B.	Tor.T.	¾ Float	Salisbury	Tor.T	120	34x4	34x4	Wood	Cant	Stewart	Plain. 3	R&P	Roll.	Roll.	Case-T-17
Plate	Sel	Unit M.	3	Sp.B.	Springs.	Semi-F	Timken	Springs.	115	32x4	32x4	Wood	S-E	Stewart	Plain. 3	Roll	Roll.	Roll.	Chalmers-6-30
Disk	Sel	Unit M.	3	Sp.B.	Springs.	Semi-F	Timken	Springs.	122	34x4	34x4	Wood	S-E	Stewart	Plain. 3	Roll	Roll.	Roll.	Chalmers-6-30
Disk	Sel	Unit M.	3	Sp.B.	Tor.T.	Float	Own	Tor.T	123	34x4	34x4	Wood	S-E	Warner	Plain. 3	Ball	Ball.	Roll.	Chandler-17
Disk	Sel	Unit M.	4	Sp.B.	Springs.	Float	Timken	Tor.R	135	35x5	35x5	Wire†	S-E	.....	Plain. 3	Roll	Roll.	Roll.	Charter Oak-A
Cone	Sel	Unit M.	3	Bevel	Springs.	¾ Float	Own	Springs.	102	30x3½	30x3½	Wood	Cant	Stewart	Plain. 3	Ball	Roll.	Ball.	Chevrolet-490
Cone	Sel	Unit M.	3	Bevel	Springs.	¾ Float	Own	Springs.	112	32x3½	32x3½	Wood	Cant	Stewart	Plain. 3	B&P	Roll.	C&C.	Chevrolet-F-5, F-2
Cone	Sel	Unit M.	3	Sp.B.	Springs.	¾ Float	Own	Tor.T	120	34x4	34x4	Wood	Cant	Stewart	Plain. 3	B&P	Roll.	C&C.	Chevrolet-D
Cone	Sel	Unit M.	3	Sp.B.	Springs.	Float	Columbia	Springs.	127	35x4½	35x4½	Wood	S-E	Warner	Plain. 3	B&P	Roll.	Roll.	Cole-860
Plate	Sel	Unit X.	3	Bevel	Tor. T.	Float	Peru	Tor.T	113	32x3½	32x3½	Opt	¾ Ell	Stewart	Plain. 2	Ball	Roll.	Ball.	Crow-Elkhart-CE-35

Bevel, Sp.B. **Car Drives Through:** Radius Rods, Rad.Rd; Torsion Tube, Tor.T; Torque Arm, Tor. A. **Rear Axle:** Floating, Float; Semi-Floating, Semi-F; Three-quarter Floating, ¾ Float. **Make of Axle:** Weston-Mott, West.M; Walker-Weiss, W.Weiss. **Rear Springs:** Elliptic, Ell; Three-quarter Elliptic ¾ Ell; Semi-Elliptic, S-E; Cantilever, Cant; Platform, Plat; Transverse Semi-Elliptic, Tr.S-E. **Bearings:** Roller, Roll; Ball and Roller, B&R; Ball and Plain, B&P; Ball, Roller and Plain, BR&P; Cup and Cone, C&C. **Make of Speedometer:** Johns-Manville, Johns-Man. **Fuel Feed;** Stewart Vacuum Tank, Vacuum.

*Wire special equipment. †Wood optional.

1917 Passenger Automobiles Listed with

MAKE AND MODEL	No. of Cylinders	Bore and Stroke, Inches	Piston Displacement Cubic Inches	Gear Ratio on Direct	Make of Engine	Cylinder Shape	Camshaft Drive	Water Circulation	LUBRICATION System	LUBRICATION Type of Pump	ELECTRIC SYSTEM Generator Make	ELECTRIC SYSTEM Voltage	IGNITION System	IGNITION Make	IGNITION Control	CARBURETION Make of Carbureter	CARBURETION Fuel Feed
Cunningham V	8	3½x5	441.7	4.08-1	Own	L	Helical	Cent	Pressure	Gear	Westinghouse	6	Single	Westinghouse	Hand	Stromberg	Vacuum
Daniels A	8	3½x5	331.8	4.42-1	Hersh-Sp	L	Helical	Cent	Pressure	Gear	Westinghouse	6	Single	Westinghouse	Hand	Zenith	Vacuum
Davis Light Six	6	3½x4½	224.0	4.42-1	Continent	L	Helical	Cent	Splash-Pres	Piston	Delco	6	Dual	Delco	Hand	Stromberg	Vacuum
Davis Big Six	6	3½x5½	303.1	4.42-1	Continent	L	Helical	Cent	Splash-Pres	Gear	Delco	6	Dual	Delco	Atmte	Stromberg	Vacuum
Detroiter Six-45	6	3½x4½	224.0	4.75-1	Continent	L	Helical	Cent	Splash-Pres	Piston	Auto-Lite	7	Single	Conn	Hand	Ball	Vacuum
Dispatch G	4	3½x5	220.9	4.00-1	Wisconsin	L	Helical	Ther	Pressure	Gear	U.S.L.	12	Single	Bosch	Hand	Rayfield	Vacuum
Dixie Flyer	4	3½x5	165.9	4.75-1	Lycoming	L	Helical	Ther	Circ-Spl	Piston	Dyneto	6	Single	Conn	Hand	Carter	Vacuum
Dodge	4	3⅞x4½	212.3	3.50-1	Own	L	Helical	Cent	Circ-Spl	Imp	North East	12	Single	Delco	Atmte	Stewart	Vacuum
Dorris 1-B-6	6	4 x5	377.0	4.08-1	Own	I	Helical	Cent	Pressure	Gear	Westinghouse	6	Single	Bosch	Hand	Stromberg	Vacuum
Dort 9	4	3½x5	165.9	4.07-1	Own	L	Helical	Ther	Circ-Spl	Piston	Westinghouse	6	Single	Conn	Hand	Carter	Gravity
Drexel R-30-35	4	3½x5	192.4	4.25-1	Own	I	Chain	Ther	Circ-Spl	Piston	Bijur	6	Single	Bosch	Hand	Stromberg	Gravity
Drexel	4	3½x5	192.4	4.42-1	Own	I	Chain	Ther	Splash-Pres	Piston	Bijur	6	Single	Bosch	Hand	Stromberg	Vacuum
Drummond B-17	8	3 x5	282.7	4.42-1	Hersh-Sp	L	Helical	Cent	Pressure	Gear	Westinghouse	6	Single	Westinghouse	Hand	Zenith	Vacuum
Elcar D.E.F.	4	3½x5	192.4	4.08-1	Lycoming	L	Helical	Ther	Circ-Spl	Piston	Dyneto	6	Single	Delco	H&A	Carter	Vacuum
Elgin	6	3 x4½	180.2	4.50-1	Falls	I	Helical	Ther	Circ-Spl	Piston	Wagner	6	Single	Remy	Hand	Stromberg	Vacuum
Emerson	4	3¾x4	176.7	4.25-1	Own	L	Spur	Ther	Non-Splash	Gear	Apple	6	Single	At Kent	Hand	Kingston	Vacuum
Empire 45	4	3½x5	235.8	4.00-1	Tector	T	Helical	Ther	Circ-Spl		Auto-Lite	6	Single	Auto-Lite	Hand	Stromberg	Vacuum
Empire 60-R	6	3½x4½	224.0	4.42-1	Continent	L	Helical	Cent	Splash-Pres	Piston	Auto-Lite	6	Single	Conn	Hand	Stromberg	Vacuum
Empire 70	6	3½x4½	224.0	4.58-1	Continent	L	Helical	Cent	Splash-Pres		Auto-Lite	6	Single	Conn	Hand	Stromberg	Vacuum
Enger Twin Unit Twelve	12	2½x3½	238.3	4.75-1	Own	I	Chain	Gear	Pressure	Gear	Westinghouse	6	Single	Remy	Hand	Stromberg	Gravity
Fiat 55-E-17	4	5½x6¾	557.0	2.75-1	Own	L	Helical	Cent	Pressure	Gear	Westinghouse	6	Double	Westinghouse	Hand	Zenith	Pressure
Ford T	4	3¾x4	176.7	3.63-1	Own	L	Spur	Ther	Splash-Grav	Flywheel	Own	12	Single	Own	Hand	{Holley / Kingston}	Gravity
Franklin 9	6	3½x4	199.1	3.92-1	Own	I	Helical	Air	Pressure	Gear	Dyneto	12	Single	At Kent	Atmte	Own	Vacuum
F.R.P. 45-A	4	4⅛x6¾	448.0	2.25-1	Own	I	Worm	Cent	Splash-Pres	Piston	Bosch	12	2-Pt	Bosch	Hand	Longmare	Pressure
F.R.P. 45-B	4	4⅛x6¾	448.0	3.00-1	Own	I	Worm	Cent	Splash-Pres	Piston	Bosch	12	2-Pt	Bosch	Hand	Longmare	Pressure
Geneva	6	4 x5½	414.7	3.77-1	Hersh-Sp	T	Helical	Cent	Splash-Pres	Gear	Westinghouse	6	Single	Eisemann	Hand	Rayfield	Vacuum
Glide 6-40	6	3½x5	230.1	4.64-1	Rutenber	L	Helical	Cent	Splash-Pres	Piston	Westinghouse	6	Single	Westinghouse	Hand	Rayfield	Vacuum
Grant K	6	3 x4½	180.2	4.50-1	Own	I	Helical	Ther	Non-Splash	Piston	Wagner	6	Single	Remy	Atmte	Stromberg	Vacuum
Hackett Four	4	3¾x4½	187.7	4.00-1	G.B.&S	L	Chain	Ther	Splash-Pres	Piston	G&D	6	Single	G&D	Hand		Vacuum
HAL 21A	12	2½x5	389.5	4.64-1	Weidely	I	Helical	Cent	Pressure	Piston	Westinghouse	6	Single	Westinghouse	Hand	Stromberg	Vacuum
Harroun A-1	4	3¼x5½	174.2	4.00-1	Own	L	Helical	Ther	Circ-Spl	Piston	Own	6	Single	Bosch	Hand	Bell	Gravity
Hatfield H	4	3¾x4½	187.7	4.25-1	G.B.&S	L	Chain	Ther	Circ-Spl	Piston	Disco	12	Single	Conn	Hand	Stromberg	Vacuum
Harvard 2-T	4	3 x4½	120.2	4.00-1	Sterling	L	Helical	Ther	Circ-Spl	Gear	Wagner	6	Dual		Hand	Zenith	Gravity
Haynes 36	6	3½x5	288.6	4.42-1	Own	L	Helical	Cent	Circ-Spl	Piston	Leece-N	6	Single	Remy	Hand	Rayfield	Vacuum
Haynes 37	6	3½x5	288.6	4.42-1	Own	L	Helical	Cent	Circ-Spl	Piston	Leece-N	6	Single	Remy	Hand	Rayfield	Vacuum
Haynes 40	12	2½x5	356.4	4.42-1	Own	I	Chain	Cent	Pressure	Gear	Leece-N	6	Single	Delco	H&A	Rayfield	Vacuum
Haynes 41	12	2½x5	356.4	4.42-1	Own	I	Chain	Cent	Pressure	Gear	Leece-N	6	Single	Delco	H&A	Rayfield	Vacuum
Hollier 186	6	3 x4½	180.2	4.50-1	Falls	I	Helical	Ther	Circ-Spl	Gear	Allis-Ch	6	Single	Remy	Hand	Stewart	Vacuum
Hollier 178	8	3 x4½	240.3	4.50-1	Own	I	Helical	Ther	Pressure	Gear	Apco	6	Single	At Kent	Atmte	Stewart	Vacuum
Homer Laughlin D	8	2½x3¾	120.0	.....	Own	L	Chain	Ther	Circ-Spl		Disco	12	Single	At Kent	Atmte	Ensign	Pressure
Howard	6	3½x4½	224.0	4.75-1	Continent	L	Helical	Cent	Splash-Pres	Piston		6	Single	Delco	Hand	Stromberg	Vacuum
Hudson Super-Six	6	3½x5	288.6	4.45-1	Own	L	Helical	Cent	Circ-Spl	Piston	Delco	6	Single	Delco	H&A	Own	Vacuum
Hupmobile NR	4	3¾x5½	242.9	4.64-1	Own	L	Chain	Ther	Splash-Pres	Flywheel	Westinghouse	6	Single	At Kent	H&A	Zenith	Gravity
Hupmobile NU	4	3¾x5½	242.9	4.64-1	Own	L	Chain	Ther	Splash-Pres	Flywheel	Westinghouse	6	Single	At Kent	H&A	Zenith	Gravity
Hupmobile N	4	3¾x5½	242.9	4.64-1	Own	L	Chain	Ther	Splash-Pres	Flywheel	Westinghouse	6	Single	At Kent	H&A	Zenith	Gravity
Hupmobile NQ	4	3¾x5½	242.9	4.64-1	Own	L	Chain	Ther	Splash-Pres	Flywheel	Westinghouse	6	Single	At Kent	H&A	Zenith	Gravity
Inter-State T	4	3½x5	192.4	4.00-1	Own	L	Helical	Ther	Circ-Spl	Gear	Remy	6	Single	Remy	Hand	Schebler	Gravity
Jackson Wolverine 349	8	3 x3½	197.9	4.75-1	Ferro	I	Helical	Ther	Pressure	Gear	Auto-Lite	6	Single	Auto-Lite	Hand	Zenith	Vacuum
Jeffery 472	4	3¾x5½	231.9	4.50-1	Own	L	Helical	Cent	Splash-Pres	Piston	Bijur	6	Single	Dixie	Hand	Stromberg	Vacuum
Jeffery 671	6	3¼x4⅜	267.0	4.50-1	Own	L	Chain	Cent	Splash-Pres	Gear	Bijur	6	Single	Dixie	Hand	Rayfield	Vacuum

ABBREVIATIONS:—Make of Engine: Continental, Continent; Herschell-Spillman, Hersh-Sp; Golden, Belknap & Swartz, G.B.&S.; Massnick-Phipps, Mass-Ph. **Cylinder Shape:** L-Head, L; I-Head, I; T-Head, T. **Camshaft Drive:** Spur Gears, Spur. **Water Circulation:** Centrifugal, Cent; Thermo-syphon, Ther. **Lubrication System:** Splash-Pressure, Splash-Pres; Circulating-Splash, Circ-Spl. **Oil Pump Type:** Impeller, Imp. **Electric System:** Ward Leonard, Ward-L; Gray & Davis, G & D; Allis-Chalmers, Allis-Ch; Leece-Neville, Leece-N. **Ignition System:** Dual-Double, Dual-D. **Ignition Make:** Atwater Kent, At Kent. **Ignition Control:** Hand and Automatic, H&A; Automatic, Atmte. **Make of Carbureter:** Reichenbach, Reichbch; Longuemare, Longmare. **Clutch Type:** Multiple Disk, Mul-D. **Gearset Type:** Selective, Sel; Planetary, Plan; Friction, Fric. **Gearset Location:** Unit with Motor, Unit M; Unit with Axle, Unit X; Amidship, Amid; Unit with Torque Tube, Unit T. **Final Drive:** Spiral

Their Technical Specifications—Continued

MAKE AND MODEL	TRANSMISSION: Clutch Type	GEARSET: Type	GEARSET: Location	GEARSET: Forward Sp'ds	Final Drive	Car Drives Through	Rear Axle Type	Make of Rear Axle	Torque Taken By	RUNNING GEAR: Wheelbase	TIRES: Front	TIRES: Rear	Wheels	Rear Springs	Make of Speedometer	Crankshaft Bearings: Number	BEARINGS: Gearset	BEARINGS: Rear Axle	BEARINGS: Front Wheel
Cunningham V	Disk	Sel	Unit M.	3	Sp.B	Springs	Float		Tor.T	130	35x5	35x5	Wood	¾ Ell	Stewart	Plain 3	B&R		Roll
Daniels A	Disk	Sel	Unit M.	3	Sp.B	Springs	¾ Float	Timken	Tor.T	127	34x4½	34x4½	Wood	S-E	Warner	Plain 3	B&R	Roll	Roll
Davis Light Six	Cone	Sel	Unit M.	3	Sp.B	Springs	¾ Float	Columbia	Springs	118	34x4	34x4	Wood	S-E	Stewart	Plain 3	Ball	Roll	Ball
Davis Big Six	Cone	Sel	Unit M.	3	Sp.B	Springs	Float	Columbia	Springs	124	34x4½	34x4½	Wood	S-E	Stewart	Plain 3	Ball	Roll	Roll
Detroiter Six-45	Plate	Sel	Unit M.	3	Sp.B	Springs	Semi-F	Timken	Springs	118	33x4	33x4	Wood	S-E	Stewart	Plain 3	B&P	Roll	Roll
Dispatch G	Control	Unit	Amid	4	Dbl Ch	Rad.Rd	Dead	Own	Rad.Rd	120	36x3½	36x3½	Wood	Ell	Corbin	Plain 3	Ball	Ball	Ball
Dixie Flyer	Cone	Sel	Unit M.	3	Sp.B	Tor.T	Float	Peru	Tor.T	112	32x3½	32x3½	Wood	¾ Ell	VanSicklen	Plain 2	BR&P	B&R	Ball
Dodge	Disk	Sel	Unit M.	3	Sp.B	Springs	Float	Own	Tor.T	114	32x3½	32x3½	Wood	¾ Ell	Johns-Man	Plain 3	Ball	Roll	Roll
Dorris 1-B-6	Disk	Sel	Unit M.	3	Sp.B	Springs	Float	Timken	Tor.T	128	36x4½	36x4½	Wood	S-E	Warner	Plain 7	Roll	Roll	Roll
Dort 9	Cone	Sel	Unit M.	3	Bevel	Springs	¾ Float	W-Weiss	Tor.T	105	30x3½	30x3½	Wood	Cant	Stewart	Plain 2	Ball	BR&P	Ball
Drexel R-30-35	Cone	Sel	Unit M.	3	Bevel	Tor.T	Float	Peru	Tor.T	112	33x4	33x4	Wood	¾ Ell	Stewart	Plain 2	Ball	Roll	Ball
Drexel	Disk	Sel	Unit M.	3	Sp.B	Springs	Semi-F	Timken	Springs	118	34x4	34x4	Wood	S-E	Stewart	Plain 2	Ball	Roll	Roll
Drummond B-17	Disk	Sel	Unit M.	3	Sp.B	Tor.T	Float	Columbia	Tor.T	120	34x4	34x4	Wood	Cant		Plain 3	Ball	Roll	Roll
Elcar D.E.F.	Plate	Sel	Unit M.	3	Sp.B	Springs	Float	Salisbury	Springs	115	32x3½	32x3½	Opt	S-E	Stewart	Plain 2	B&P	B&R	Ball
Elgin	Plate	Sel	Unit M.	3	Sp.B	Springs	Float	Salisbury	Tor.A	116	33x4	33x4	Opt	Cant	Stewart	Plain 3	Ball	Ball	Ball
Emerson	Disk	Sel	Unit M.	3	Bevel	Springs	Semi-F	Own	Springs	110	30x3	30x3½	Wood	S-E	Extra	Plain 3	Ball	B&R	Ball
Empire 45	Cone	Sel	Unit M.	3	Bevel	Springs	¾ Float	West.M	Tor.T	116	33x4	33x4	Wood	S-E		Plain 3	B&P	Roll	Ball
Empire 60-R	Cone	Sel	Unit M.	3	Bevel	Springs	¾ Float	West.M	Springs	120	34x4	34x4	Wood	¾ Ell		Plain	B&P	Roll	Ball
Empire 70	Plate	Sel	Unit M.	3	Sp.B	Springs	Float	Hess	Springs	120	34x4	34x4	Wood	¾ Ell		Plain 3	B&P	B&R	Ball
Enger Twin Unit Twelve	Plate	Sel	Unit M.	3	Sp.B	Springs	Float	Hess	Tor.T	116	32x4	32x4	Wood	Cant	Stewart	Plain 3	B&P	B&R	Ball
Fiat 55-E-17	Disk	Sel	Amid	4	Bevel	Tor.T	Semi-F	Own	Tor.T	140	35x5	35x5	Wood	S-E	Warner	Plain 3	Ball	Ball	Ball
Ford T	Mul-D	Plan	Unit M.	2	Bevel	Tor.T	Semi-F	Own	Tor.T	100	30x3	30x3½	Wood	Tr.S-E	None	Plain 3	Plain	Roll	Ball
Franklin 9	Disk	Sel	Amid	3	Sp.B	Springs	Semi-F	Own	Springs	115	32x4	32x4	Wood	Ell	Warner	Plain 7	Ball	Ball	Ball
F.R.P 45-A	Cone	Sel	Amid	4	Bevel	Springs	Float	Own	Tor.T	110	36x4½	36x5	Wire	S-E		Plain 3	Ball	Ball	Ball
F.R.P 45-B	Cone	Sel	Amid	4	Bevel	Springs	Float	Own	Tor.T	140	36x4½	36x5	Wire	S-E		Plain 3	Ball	Ball	Ball
Geneva	Disk	Sel	Unit M.	4	Sp.B	Springs	Float	Timken	Springs	139	34x4½	34x4½	Opt	S-E	Warner	Plain 3	Roll	Roll	Roll
Glide 6-40	Disk	Sel	Unit M.	3	Sp.B	Springs	¾ Float	Amer	Springs	119	34x4	34x4	Wood	¾ Ell	Stewart	Plain 3	B&P	Ball	Ball
Grant K	Cone	Sel	Unit M.	3	Bevel	Tor.T	Float	Peru	Tor.T	112	32x3½	32x3½	Wood*	Cant	Stewart	Plain 3	B&P	B&R	Ball
Hackett Four	Disk	Sel	Unit M.	3	Bevel	Springs	¾ Float	W-Weiss	Springs	112	31x4	31x4	Wood	¾ Ell	Stewart	Plain 3	Roll	Roll	Ball
HAL 21A	Plate	Sel	Unit M.	3	Sp.B	Springs	Float	Timken	Springs	135	34x4½	34x4½	Opt	S-E		Plain 3	Ball	Roll	Roll
Harroun A-1	Cone	Sel	Unit M.	3	Bevel	Springs	Float	Own	Tor.T	107	30x3½	30x3½	Wood	Cant		Plain 3	Ball		Roll
Hatfield H	Disk	Sel	Unit M.	3	Bevel	Springs	Float	Peru	Springs	106	31x4	31x4	Wood	Cant	Stewart	Plain 3	Ball	Roll	Ball
Harvard 2-T	Cone	Sel	Unit M.	3	Bevel	Springs	Semi-F	Detroit	Springs	100	28x3	28x3	Opt	Cant		Plain	B&P	B&R	Ball
Haynes 36	Plate	Sel	Unit M.	3	Sp.B	Springs	¾ Float	Own	Springs	121	34x4	34x4	Wood	S-E	Stewart	Plain 3	Ball	Ball	Ball
Haynes 37	Plate	Sel	Unit M.	3	Sp.B	Springs	¾ Float	Own	Springs	127	35x4½	35x4½	Wood	S-E	Stewart	Plain 3	Ball	Ball	Ball
Haynes 40	Plate	Sel	Unit M.	3	Sp.B	Springs	¾ Float	Own	Springs	121	34x4½	34x4½	Wire	S-E	Warner	Plain 3	Ball	Ball	Ball
Haynes 41	Plate	Sel	Unit M.	3	Sp.B	Springs	¾ Float	Own	Springs	127	34x4½	34x4½	Wire	S-E	Warner	Plain 3	Ball	Ball	Ball
Hollier 186	Cone	Sel	Unit M.	3	Bevel	Tor.T	Float	Own	Springs	116	32x3½	32x3½	Wood	Cant	Stewart	Plain 3	Ball	Ball	Roll
Hollier 178	Cone	Sel	Unit M.	3	Bevel	Tor.T	Float	Own	Springs	116	34x4	34x4	Wood	Cant	Stewart	Plain 3	Ball	Ball	Roll
Homer Laughlin D		Fric	Amid	3	Dbl Ch	Rad.Rd	Dead	Own		112	30x3½	30x3½	Wire	Cant	Stewart	Ball 2	Ball	Ball	Ball
Howard	Plate	Sel	Unit M.	3	Sp.B	Springs	Float	Hess	Springs	118	32x4	32x4	Opt	S-E		Plain 3	Ball	B&R	Roll
Hudson Super-Six	Disk	Sel	Unit M.	3	Sp.B	Springs	Semi-F	Timken	Springs	125½	35x4½	35x4½	Wood*	S-E	Warner	Plain 4	R&P	Roll	Roll
Hupmobile NR	Disk	Sel	Unit M.	3	Sp.B	Springs	¾ Float	Own	Springs	119	34x4	34x4	Wood*	S-E	VanSicklen	Plain 3	B&R	Ball	Roll
Hupmobile NU	Disk	Sel	Unit M.	3	Sp.B	Springs	¾ Float	Own	Springs	134	35x4½	35x4½	Wood*	S-E	VanSicklen	Plain 3	B&R	Ball	Roll
Hupmobile N	Disk	Sel	Unit M.	3	Sp.B	Springs	¾ Float	Own	Springs	119	34x4	34x4	Wood*	S-E	VanSicklen	Plain 3	B&R	Ball	Roll
Hupmobile NQ	Disk	Sel	Unit M.	3	Sp.B	Springs	¾ Float	Own	Springs	119	35x4½	35x4½	Wood*	S-E	VanSicklen	Plain 3	B&R	Ball	Roll
Inter-State T	Cone	Sel	Unit X	3	Bevel	Tor.T	¾ Float	Peru	Tor.T	110	33x4	33x4	Wood	¾ Ell	Stewart	Plain 3	BR&P	B&R	Ball
Jackson Wolverine 349	Plate	Sel	Unit M.	3	Bevel	Springs	¾ Float	Salisbury	Springs	118	34x4	34x4	Wood	Ell		Plain	Roll	Roll	B&C
Jeffery 472	Plate	Sel	Unit M.	3	Sp.B	Springs	Semi-F	Own	Springs	116	34x4	34x4	Wood	¾ Ell		Plain 3	Roll	Roll	Roll
Jeffery 671	Plate	Sel	Unit M.	3	Sp.B	Springs	Semi-F	Own	Springs	125	34x4	34x4	Wood	¾ Ell		Plain 3	Roll	Roll	Roll

Bevel, Sp.B. **Car Drives Through:** Radius Rods, Rad.Rd; Torsion Tube, Tor.T; Torque Arm, Tor. A. **Rear Axle:** Floating, Float; Semi-Floating, Semi-F; Three-quarter Floating, ¾ Float. **Make of Axle:** Weston-Mott, West.M; Walker-Weiss, W.Weiss. **Rear Springs:** Elliptic, Ell; Three-quarter Elliptic ¾ Ell; Semi-Elliptic, S-E; Cantilever, Cant; Platform, Plat; Transverse Semi-Elliptic, Tr.S-E. **Bearings:** Roller, Roll; Ball and Roller, B&R; Ball and Plain, B&P; Ball, Roller and Plain, BR&P; Cup and Cone, C&C. **Make of Speedometer:** Johns-Manville, Johns-Man. **Fuel Feed:** Stewart Vacuum Tank, Vacuum.

*Wire special equipment. †Wood optional.

1917 Passenger Automobiles Listed with

MAKE AND MODEL	No. of Cylinders	Bore and Stroke, Inches	Piston Displacement, Cubic Inches	Gear Ratio on Direct	Make of Engine	Cylinder Shape	Camshaft Drive	Water Circulation	LUBRICATION		ELECTRIC SYSTEM		IGNITION			CARBURETION	
									System	Type of Pump	Generator Make	Voltage	System	Make	Control	Make of Carbureter	Fuel Feed
Jones 26-B	6	3½x5½	303.1	5.00-1	Lewis	L	Helical	Ther	Circ-Spl	Gear	Auto-Lite	6	Dual	Auto-Lite	Hand	Stromberg	Vacuum
Jordan 69	6	3½x5½	303.1	4.47-1	Continent.	L	Helical	Cent	Splash-Pres	Piston	Bijur	6	Single	Bosch	Hand	Stromberg	Vacuum
Kent A	4	3¾x5	220.9	4.08-1	Continent.	L	Helical	Ther	Circ-Spl	Piston	Bosch	12	Dual	Bosch	2-Pt	Zenith	Vacuum
King EE	8	3 x5	282.7	4.60-1	Own	L	Chain	Ther	Pressure	Gear	Ward-L	6	Single	At Kent	H&A	Ball	Vacuum
Kissel 6-42	6	3½x5½	340.3	4.58-1	Own	L	Helical	Cent	Non-Splash	Gear	Westinghouse	6	Single	Eisemann	Hand	Stromberg	Vacuum
Kissel Hundred Pt. Six	6	3½x5	248.9	4.58-1	Own	L	Helical	Cent	Circ-Spl	Piston	Remy	6	Single	Remy	Hand	Stromberg	Vacuum
Kline 6-38F	6	3½x4½	224.0	4.50-1	Continent.	L	Helical	Cent	Splash-Pres	Piston	Westinghouse	6		Westinghouse	Hand	Rayfield	Vacuum
L																	
Lambert 90	4	4½x5½	297.8	.....	Rutenber	L	Spur	.....	Circ-Spl	Piston	Remy	6	Single	Remy	Hand	Schebler	Vacuum
Lambert 80	6	3½x4½	224.0	.....	Continent.	L	Spur	Cent	Circ-Spl	Piston	Remy	6	Single	Remy	Hand	Schebler	Vacuum
Laurel 35	4	3¾x4½	187.7	4.25-1	G.B.&S.	L	Chain	Ther	Splash-Pres	Piston	.....	6	Single	Dixie	Hand	Schebler	Gravity
Lexington 6-O-17	6	3½x4½	224.0	4.75-1	Continent.	L	Helical	Cent	Splash-Pres	Piston	Westinghouse	6	Single	Conn	Hand	Rayfield	Vacuum
Lexington 6-P	6	4½x5½	421.0	4.08-1	Continent.	L	Helical	Cent	Splash-Pres	Piston	Westinghouse	6	Double	Westinghouse	H&A	Stromberg	Vacuum
Liberty 10-A	6	3½x4½	207.1	4.75-1	Continent.	L	Helical	Ther	Splash-Pres	Piston	Delco	6	Single	Delco	Hand	Rayfield	Vacuum
Locomobile R-7 38	6	4½x5	425.6	3.85-1	Own	T	Helical	Cent	Splash-Pres	Gear	Westinghouse	6	Dual	Eisemann	Hand	Ball	Pressure
Locomobile M-7 48	6	4½x5½	524.8	3.85-1	Own	T	Helical	Cent	Splash-Pres	Gear	Westinghouse	6	Dual	Eisemann	Hand	Own	Pressure
Luverne 17	6	3¾x5½	347.9	4.00-1	Continent.	L	Chain	Gear	Circ-Spl	Gear	Bosch	12	Double	Bosch	Hand	Schebler	Vacuum
Madison 4	6	3½x5	230.1	4.64-1	Rutenber	L	Helical	Cent	Circ-Spl	Gear	Remy	6	Single	Remy	Hand	Rayfield	Vacuum
Madison	6	3½x5	230.1	4.64-1	Rutenber	L	Helical	Cent	Circ-Spl	Gear	Remy	6	Single	Remy	Hand	Rayfield	Vacuum
Madison	6	3½x5	230.1	4.64-1	Rutenber	L	Helical	Cent	Circ-Spl	Gear	Remy	6	Single	Remy	Hand	Rayfield	Vacuum
Madison 5	6	3½x5	230.1	4.64-1	Rutenber	L	Helical	Cent	Circ-Spl	Gear	Remy	6	Single	Remy	Hand	Rayfield	Vacuum
Madison 7	6	3½x5	230.1	4.64-1	Rutenber	L	Helical	Cent	Circ-Spl	Gear	Remy	6	Single	Remy	Hand	Rayfield	Vacuum
Maibohm A	4	3¾x4	122.7	4.00-1	Own	L	Helical	Ther	Splash-Pres	Piston	Disco	12	Single	At Kent	Atmtc	Zenith	Gravity
Majestic M	8	3x5	282.7	.....	.....	.....	Chain	Ther	Pressure	Gear	Rob Myers	6	Single	At Kent	Hand	.....	Vacuum
Majestic A	8	3½x5	331.8	.....	.....	.....	Helical	Gear	Pressure	Gear	Rob Myers	6	Single	At Kent	Hand	.....	Vacuum
Marion-Handley A 6-40	6	3½x5	230.1	4.42-1	Rutenber	L	Helical	Cent	Splash-Pres	Piston	Westinghouse	6	Single	Westinghouse	Hand	Stromberg	Vacuum
Marion-Handley B 6-60	6	3½x5½	303.1	4.08-1	Continent.	L	Helical	Cent	Splash-Pres	Piston	Westinghouse	6	Single	Westinghouse	Hand	Stromberg	Vacuum
Marmon 34	6	3¾x5½	339.7	3.69-1	Own	I	Helical	Cent	Pressure	Gear	Bosch	12	Single	Bosch	Hand	Stromberg	Gravity
Maxwell 25	4	3½x4½	185.8	3.58-1	Own	L	Helical	Ther	Circ-Spl	Piston	Simms-Huff	6	Dual	At Kent	Hand	K-D	Gravity
McFarlan	6	4½x6	572.5	3.50-1	Teetor	T	Helical	Cent	Splash-Pres	Piston	Westinghouse	6	Double	Bosch	Hand	Stromberg	Vacuum
Mercer 22-73	4	3¾x6¾	298.2	3.22-1	Own	L	Chain	Cent	Pressure	Gear	U.S.L	12	Single	Bosch	Hand	Corser	Vacuum
Mercer 22-73	4	3¾x6¾	298.2	3.87-1	Own	L	Chain	Cent	Pressure	Gear	U.S.L	12	Single	Bosch	Hand	Corser	Vacuum
Metz 25	4	3½x4	188.7	4.00-1	Own	L	Spur	Ther	Non-Splash	Gear	G&D	6	Single	Dixie	Fixed	A. W. T.	Gravity
Mitchell D-40	6	3½x5	248.9	4.41-1	Own	L	Helical	Cent	Circ-Spl	Piston	Splitdorf	6	Single	Conn	Hand	Rayfield	Vacuum
Mitchell C-42	6	3½x5	288.6	4.41-1	Own	L	Helical	Cent	Circ-Spl	Piston	Westinghouse	6	Single	Conn	Hand	Rayfield	Vacuum
Moline-Knight C. MK-40	4	3¾x5	220.9	4.30-1	Own	I	Chain	Ther	Pressure	Gear	Wagner	6	Single	Conn	Hand	Schebler	Vacuum
Moline-Knight G. MK-50	4	4 x6	301.6	4.00-1	Own	I	Chain	Ther	Pressure	Gear	Wagner	6	Single	Conn	Hand	Schebler	Vacuum
Monitor C&R	4	3½x4½	187.7	4.00-1	G.B.&S.	L	Chain	Ther	Pressure	.....	Heinze	6	Dual	Heinze	Hand	Schebler	Vacuum
Monitor N&O	6	3½x4½	224.0	4.00-1	Continent.	L	Helical	Cent	Circ-Spl	.....	Heinze	6	Dual	Heinze	Hand	Stromberg	Vacuum
Monroe M-3	4	3 x4½	120.2	4.25-1	Sterling	I	Helical	Ther	Circ-Splash	Piston	Auto-Lite	6	Single	Conn	Hand	Zenith	Gravity
Monroe M-4	4	3½x4½	149.3	4.75-1	Own	I	Helical	Ther	Pressure	Gear	Auto-Lite	6	Single	Conn	Hand	Zenith	Vacuum
Moon 6-43	6	3½x4½	224.0	4.75-1	Continent.	L	Helical	Cent	Splash-Pres	Piston	Delco	6	Single	Delco	Hand	Rayfield	Vacuum
Moon 6-66	6	3½x5½	303.1	4.42-1	Continent.	L	Helical	Cent	Splash-Pres	Piston	Delco	6	Single	Delco	Atmtc	Rayfield	Vacuum
Moore 30 35	4	3¾x4½	187.7	3.70-1	G.B.&S.	L	Chain	Ther	Circ-Spl	Gear	Disco	6	Single	Dixie	Hand	Schebler	Vacuum
Murray 70-T	8	3½x5	331.8	4.47-1	Hersh-Sp	L	Helical	Cent	Pressure	Gear	.....	6	Single	Dixie	Hand	Zenith	Vacuum
Napoleon 30	4	3½x5	192.4	4.00-1	Lycoming	L	Helical	Ther	Circ-Spl	Piston	Dyneto	6	Single	Conn	Hand	Carter	Vacuum
National Highway 6	6	3½x5½	303.1	4.58-1	Own	L	Helical	Cent	Splash-Pres	Piston	Westinghouse	6	Single	Dixie	Hand	Rayfield	Vacuum
National Highway 12	12	2½x4½	370.1	5.00-1	Own	L	Helical	Cent	Pressure	Gear	Bijur	6	Single	Delco	Hand	Rayfield	Vacuum
Oakland 34	6	2⅞x4⅜	177.0	4.50-1	Northway	I	Helical	Cent	Circ-Spl	Piston	Delco	6	Single	Delco	Hand	Marvel	Vacuum
Oakland 50	8	3½x4½	346.3	4.08-1	Northway	L	Helical	Cent	Splash-Pres	Gear	Delco	6	Single	Delco	H&A	Stromberg	Vacuum
Ogren 102	6	3½x5½	347.9	3.75-1	Continent.	L	.....	Cent	Pressure	Gear	Westinghouse	6	Dual	Bosch	H&F	Rayfield	Vacuum
Oldsmobile 45	8	2½x4½	246.7	4.92-1	.....	L	Helical	Cent	Pressure	Gear	Delco	6	Single	Delco	H&A	Johnson	Vacuum
Overland 90	4	3½x5	178.9	3.75-1	Own	L	Helical	Ther	Circ-Spl	Piston	Auto-Lite	6	Single	Conn	Hand	Tillotson	Vacuum
Overland 85	4	4¼x4½	240.5	4.00-1	Own	L	Helical	Ther	Circ-Spl	Gear	Auto-Lite	6	Single	Conn	Hand	Tillotson	Vacuum
Overland 85	6	3½x4½	224.0	4.00-1	Continent.	L	Helical	Cent	Pressure	Gear	Auto-Lite	6	Single	Conn	Hand	Tillotson	Vacuum
Owen Magnetic M-25	6	3½x5½	303.1	4.50-1	Continent.	L	Helical	Cent	Splash-Pres	Piston	Own	24	Single	Bosch	Hand	Zenith	Vacuum
Owen Magnetic O-36	6	3½x5½	364.5	3.50-1	Buda	L	Helical	Cent*	Splash-Pres	Gear	Own	24	Single	Bosch	Hand	Zenith	Vacuum

ABBREVIATIONS:—Make of Engine: Continental, Continent; Herschell-Spillman, Hersh-Sp; Golden, Belknap & Swartz, G.B.&S.; Massnick-Phipps, Mass-Ph. **Cylinder Shape:** L-Head, L; I-Head, I; T-Head, T. **Camshaft Drive:** Spur Gears, Spur. **Water Circulation:** Centrifugal, Cent; Thermo-syphon, Ther. **Lubrication System:** Splash-Pressure, Splash-Pres; Circulating-Splash, Circ-Spl. **Oil Pump Type:** Impeller, Imp. **Electric System:** Ward Leonard, Ward-L; Gray & Davis, G&D; Allis-Chalmers, Allis-Ch; Leece-Neville, Leece-N. **Ignition System:** Dual-Double, Dual-D. **Ignition Make:** Atwater Kent, At Kent. **Ignition Control:** Hand and Automatic, H&A; Automatic, Atmtc. **Make of Carbureter:** Reichenbach, Reichbch; Longuemare, Longmare. **Clutch Type:** Multiple Disk, Mul-D. **Gearset Type:** Selective, Sel; Planetary, Plan; Friction, Fric. **Gearset Location:** Unit with Motor, Unit M; Unit with Axle, Unit X; Amidship, Amid; Unit with Torque Tube, Unit T. **Final Drive:** Spiral

Their Technical Specifications—Continued

TRANSMISSION									RUNNING GEAR							BEARINGS			
	GEARSET									TIRES					Crankshaft Bearings				
Clutch Type	Type	Location	Forward Sp'ds	Final Drive	Car Drives Through	Rear Axle Type	Make of Rear Axle	Torque Taken By	Wheelbase	Front	Rear	Wheels	Rear Springs	Make of Speedometer	Number		Gearset	Rear Axle	Front Wheel	MAKE AND MODEL
Plate	Sel	Unit M	3	Bevel	Springs	Float	Timken	Springs	125	35x4½	35x4½	Wood	S-E		Plain	3	Roll	Roll	Roll	Jones 26-B
Disk	Sel	Unit M	3	Sp.B	Springs	Semi-F	Timken	Springs	127	35x4½	35x4½	Wood	S-E	VanSicklen	Plain	3	Ball	Roll	Roll	Jordan 60
Disk	Sel	Unit M	3	Sp.B	Springs	¾ Float	Timken	Springs	116	32x4	32x4	Opt	¾ Ell		Plain	3	Plain	Plain	Roll	Kent A
Plate	Sel	Unit M	3	Sp.B	Springs	¾ Float	American	Tor.A	120	34x4	34x4	Wood	Cant	Stewart	Plain	3	R&P		Ball	King EE
Disk	Sel	Unit M	3	Sp.B	Springs	Float	Own	Springs	128	34x4	34x4	Wood	¾ Ell	Stewart	Plain	3	Ball	Roll	Roll	Kissel 6-42
Cone	Sel	Unit M	3	Sp.B	Springs	Float	Own	Springs	117	32x4	32x4	Opt	¾ Ell	Stewart	Plain	3	Ball	Roll	Roll	Kissel Hundred Pt. Six
Plate	Sel	Unit M	3	Sp.B	Springs	Float	Hess	Springs	120	34x4	34x4	Wood	¾ Ell		Plain	3	Ball	Roll	Ball	Kline 6-38-F
	Fric					Semi-F	Salisbury		115	34x3½	34x3½	Wood	Ell						Ball	Lambert 90
	Fric					Semi-F	Salisbury		112	33x4	33x4	Wood	Ell		Plain	3			Ball	Lambert 80
Disk	Sel	Unit M	3	Bevel	Springs	Float	Peru	Tor.T	112	32x3½	32x3½	Wood*	Cant	Stewart	Plain	3	Ball	Roll	Ball	Laurel 35
Plate	Sel	Unit M	3	Sp.B	Springs	¾ Float	Hess	Springs	116	32x4	32x4	Wood*	¾ Ell	Stewart	Plain	3	B&P	B&R	Ball	Lexington 6-O-17
Cone	Sel	Unit M	3	Sp.B	Springs	Float	Timken	Tor.T	144	36x4½	36x4½	Wood*	¾ Ell	Stewart	Plain	3	Ball	Roll	Roll	Lexington 6-P
Plate	Sel	Unit M	3	Sp.B	Springs	Semi-F	Timken	Springs	115	32x4	32x4	Wood	S-E		Plain	3	Ball	Roll	Roll	Liberty 10-A
Disk	Sel	Amid	4	Sp.B	Rad.Rd	Float	Own	Tor.A	139	36x4½	37x5	Wood	¾ Ell	Warner	Plain	7	Ball	Ball	Roll	Locomobile R-7 38
Disk	Sel	Amid	4	Sp.B	Rad.Rd	Float	Own	Tor.A	142	37x5	37x5	Wood	¾ Ell	Warner	Plain	7	Ball	Ball	Roll	Locomobile M-7 48
Disk	Sel	Unit M	3	Sp.B	Springs	Float	Hess	Springs	132	35x4½	35x4½	Wood	S-E		Plain	3	Ball	B&R	Roll	Luverne 17
Disk	Sel	Unit M		Sp.B	Springs	Float	American	Springs	120	34x4	34x4	Wood	¾ Ell	Stewart	Plain	3	Ball	Ball	Ball	Madison 4
Disk	Sel	Unit M	3	Sp.B	Springs	Float	American	Springs	115	34x4	34x4	Wood	Ell		Plain	3	Ball	Ball	Ball	Madison
Disk	Sel	Unit M	3	Sp.B	Springs	Float	American	Springs	124	34x4	34x4	Wood	Ell		Plain	3	Ball	Ball	Ball	Madison
Disk	Sel	Unit M	3	Sp.B	Springs	Float	American	Springs	115	34x4	34x4	Wood	Ell	Stewart	Plain	3	Ball	Ball	Ball	Madison 5
Disk	Sel	Unit M	3	Sp.B	Springs	Float	American	Springs	124	34x4	34x4	Wood	¾ Ell	Stewart	Plain	3	Ball	Ball	Ball	Madison 7
Disk	Sel	Unit M	3	Bevel	Springs	¾ Float	Detroit	Springs	105	30x3½	30x3½	Opt	S-E	Stewart	Plain	2	Ball	Ball	Ball	Maibohm A
Plate	Sel	Unit M	3	Sp.B	Springs	¾ Float		Springs	125	32x4	32x4	Wood	S-E	Stewart	Plain	3	B&R	Roll	Ball	Majestic M
Plate	Sel	Unit M	3	Sp.B	Springs	Float		Springs	135	35x5	35x5	Wire	S-E	Stewart	Plain	3	B&R	Ball	Ball	Majestic A
Disk	Sel	Unit M	3	Sp.B	Springs	¾ Float	Salisbury	Springs	120	32x4	32x4	Wood	S-E	Stewart	Plain	3	B&P		Ball	Marion-Handley A 6-40
Disk	Sel	Unit M	3	Sp.B	Springs	¾ Float	Salisbury	Springs	125	35x4½	35x4½	Wood	S-E	Stewart	Plain	3	Ball	B&R	Ball	Marion-Handley B 6-60
Cone	Sel	Unit T	3	Sp.B	Tor.T	¾ Float	Own	Tor.T	136	34x4½	34x4½	Wire	Trans	VanSicklen	Plain	4	BR&P	B&R	Roll	Marmon 34
Cone	Sel	Unit M	3	Bevel	Springs	¾ Float	Own	Tor.T	103	30x3½	30x3½	Wood	¾ Ell	Stewart	Plain	2	R&P	Roll	Ball	Maxwell 25
Plate	Sel	Amid	3	Sp.B	Springs	Float	Timken	Tor.A	136	35x5	35x5	Opt	S-E	Warner	Plain	4	Roll	Roll	Roll	McFarlan
Disk	Sel	Amid	4	Sp.B	Springs	Float	Own	Springs	115	32x4	32x4	Wood	S-E	Warner	Plain	3	Ball	B&R	Roll	Mercer 22-73
Disk	Sel	Amid	4	Sp.B	Springs	Float	Own	Springs	132	34x4½	34x4½	Wood	S-E	Warner	Plain	3	Ball	B&R	Roll	Mercer 22-73
	Fric	Amid	7	S Chain	Rad.Rd		Own	Rad.Rd	108	32x3½	32x3½	Wood	Ell	A.W.T	Plain	3		Roll	Ball	Metz 25
Cone	Sel	Amid	3	Sp.B	Springs	¾ Float	Own	Tor.T	120	32x4	32x4	Wood	Cant	Stewart	Plain	3	BR&P	B&R	Ball	Mitchell D-40
Cone	Sel	Amid	3	Bevel	Springs	Float	Own	Tor.T	127	34x4	34x4	Wood	Cant	Stewart	Plain	3	BR&P	B&R	Roll	Mitchell C-42
Cone	Sel	Amid	3	Sp.B	Rad.Rd	Semi-F	Timken	Rad.Rd	118	34x4	34x4	Wood	Trans	Stewart	Plain	3	R&P	Roll	Roll	Moline-Knight C MK-40
Cone	Sel	Amid	3	Sp.B	Rad.Rd	¾ Float	West.M	Rad.Rd	122	35x4½	35x4½	Wood	Trans	Stewart	Plain	3	R&P	Roll	Ball	Moline-Knight G MK-50
Disk	Sel	Unit M		Bevel	Springs	Semi-F	Russell	Springs	108	32x3½	32x3½	Wood	¾ Ell		Plain	3	B&R	Roll	Ball	Monitor C&R
Disk	Sel	Unit M	3	Bevel	Springs	Semi-F	Russell	Springs	115	33x4	33x4	Wood	¾ Ell		Plain	3	B&R	Roll	Ball	Monitor N&O
Disk	Sel	Unit M	3	Bevel	Springs	¾ Float	West.M	Springs	96	30x3	30x3	Wood	¾ Ell	Stewart	Plain	2	Ball	Roll	Ball	Monroe M-3
Disk	Sel	Unit M	3	Sp.B	Tor A	Special	Hess	Tor.A	115	32x4	32x4	Wood	Cant	Stewart	Plain	2	Ball	Roll	Roll	Monroe M-4
Disk	Sel	Unit M	3	Sp.B	Springs	Float	Hess	Springs	118	33x4	33x4	Wood	S-E	Stewart	Plain	3	B&P	B&R	Ball	Moon 6-43
Disk	Sel	Unit M	3	Sp.B	Springs	Semi-F	Timken	Springs	125	35x4½	35x4½	Wood	S-E	Stewart	Plain	3	B&P	Roll	Roll	Moon 6-66
Disk	Sel	Unit M	3	Sp.B	Tor.A	Float	Peru	Tor.T	106	30x3½	30x3½	Wood	Cant		Plain		Ball	B&P	Ball	Moore 30 35
Plate	Sel	Unit M	3	Sp.B	Springs	Float	Timken	Springs	128	34x4½	34x4½	Opt	¾ Ell	Warner	Plain	3	Roll	Roll	Roll	Murray 70-T
Disk	Sel	Unit M	3	Bevel	Springs	Semi-F		Tor.T	112	31x4	31x4	Wood	Cant		Plain	2	Ball	B&R	Ball	Napoleon 30
Cone	Sel	Unit M	3	Sp.B	Springs	Float	Columbia	Tor.R	128	34x4½	34x4½	Wood	Cant	Warner	Plain	3	Ball	Roll	Roll	National Highway 6
Cone	Sel	Unit M	3	Sp.B	Springs	Float	Columbia	Tor.R	128	34x4½	34x4½	Wood	Cant	Warner	Plain	3	Ball	Roll	Roll	National Highway 12
Cone	Sel	Unit M	3	Bevel	Springs	Float	West.M	Springs	112	32x4	32x4	Wood	S-E		Plain	3	BR&P	Roll	Ball	Oakland 34
Cone	Sel	Unit M	3	Sp.B	Springs	Float	West.M	Springs	127	34x4½	34x4½	Wood	¾ Ell		Plain	3	BR&P	Roll	Ball	Oakland 50
Disk	Sel	Unit M	3	Bevel	Springs	Float	Timken	Springs	132	34x4½	34x4½	Wire	S-E	Stewart	Roll		Roll		Roll	Ogren 102
Cone	Sel	Unit M	3	Sp.B	Springs	Float	West.M	Springs	120	33x4	33x4	Wood	¾ Ell	Stewart	Plain	2	B&R	B&R	Roll	Oldsmobile 45
Cone	Sel	Unit X	3	Bevel	Tor.T	¾ Float	Own	Tor.T	104	31x4	31x4	Wire	Cant	Stewart	Plain	2	B&R	B&R	Roll	Overland 90
Cone	Sel	Unit X	3	Bevel	Tor.T	¾ Float	Own	Tor.T	112	32x4	3 1x4	Wood	Cant	Stewart	Plain	5	B&R	B&R	Roll	Overland 85
Cone	Sel	Unit X	3	Sp.B	Tor.T	¾ Float	Own	Tor.T	116	32x4	32x4	Wood	Cant	Stewart	Plain	3	B&R	B&R	Roll	Overland 85
Owen			6	Sp.B	Springs	¾ Float	Timken	Springs	125	34x4½	34x4½	Wood	S-E	Warner	Plain	3		Roll		Owen Magnetic M-25
Owen			6	Sp.B	Tor.A	Float	American	Tor.T	136	35x5	35x5	Wire	S-E	Warner	Plain	4		Roll		Owen Magnetic O-36

Bevel, Sp.B. **Car Drives Through:** Radius Rods, Rad.Rd; Torsion Tube, Tor.T; Torque Arm, Tor. A. **Rear Axle:** Floating, Float; Semi-Floating, Semi-F; Three-quarter Floating, ¾ Float. **Make of Axle:** Weston-Mott, West.M; Walker-Weiss, W.Weiss. **Rear Springs:** Elliptic, Ell; Three-quarter Elliptic ¾ Ell; Semi-Elliptic, S-E; Cantilever, Cant; Platform, Plat; Transverse Semi-Elliptic, Tr.S-E. **Bearings:** Roller, Roll; Ball and Roller, B&R; Ball and Plain, B&P; Ball, Roller and Plain, BR&P; Cup and Cone, C&C. **Make of Speedometer:** Johns-Manville, Johns-Man. **Fuel Feed;** Stewart Vacuum Tank, Vacuum.

*Wire special equipment. †Wood optional.

1917 Passenger Automobiles Listed with

MAKE AND MODEL	No. of Cylinders	Bore and Stroke, Inches	Piston Displacement, Cubic Inches	Gear Ratio on Direct	Make of Engine	Cylinder Shape	Camshaft Drive	Water Circulation	LUBRICATION System	LUBRICATION Type of Pump	ELECTRIC SYSTEM Generator Make	ELECTRIC SYSTEM Voltage	IGNITION System	IGNITION Make	IGNITION Control	CARBURETION Make of Carbureter	CARBURETION Fuel Feed
Packard 2-25, 2-35	12	3 x5	424.1	4.36–1	Own	L	Chain	Cent	Pressure	Gear	Bijur	6	Single	Delco	H&A	Own	pressure
Paige Fleetwood 6-38	6	3½x5	230.1	4.41–1	Rutenber	L	Helical	Cent	Splash-Pres	Piston	G&D	6	Single	Remy	Hand	Rayfield	Gravity
Paige Fairfield 6-46	6	3½x5½	303.1	4.35–1	Continent	L	Helical	Cent	Splash-Pres	Piston	G&D	6	Single	Remy	Hand	Rayfield	Gravity
Partin-Palmer 20	4	3½x4½	138.1	4.00–1	LeRoi	L	Helical	Ther	Circ-Spl	Piston	Allis-Ch	6	Single	Conn	Hand	Schebler	Gravity
Partin-Palmer 32	4	3½x5	192.4	4.00–1	Lycoming	L	Helical	Ther	Circ-Spl	Gear	Disco	6	Single	Conn	Hand	Carter	Vacuum
Paterson 6-45	6	3½x4½	224.0	4.50–1	Continent	L	Helical	Cent	Splash-Pres	Piston	Delco	6	Dual	Delco	Hand	Stromberg	Vacuum
Pathfinder 2B-TC-2C	12	2½x5	389.5	4.33–1	Weidely	I	Helical	Gear	Pressure	Gear	Delco	6	Duplex	Delco	H&A	Stromberg	Vacuum
Pathfinder 3b	12	2½x5	389.5	4.33–1	Weidely	I	Helical	Cent	Splash-Pres	Gear	Delco	6	Single	Delco	Hand	Stromberg	Gravity
Peerless 56	8	3½x5	331.8	4.45–1	Own	L	Helical	Cent	Pressure	Gear	G&D	6	Single	At Kent	H&A	Ball	Vacuum
Phianna M	4	3 15/16x6	287.0	4.00–1	Own	L	Chain	Cent	Pressure	Gear	Ward-L	6	Single	Bosch	Hand	H&N	Vacuum
Pierce-Arrow 38-C-4	6	4 x5½	414.7	3.78–1	Own	T	Helical	Cent	Pressure	Gear	Westinghouse	6	Dual-D	Bosch	Hand	Own	Pressure
Pierce-Arrow 48-B-4	6	4½x5½	524.8	3.53–1	Own	T	Helical	Cent	Pressure	Gear	Westinghouse	6	Dual-D	Bosch	Hand	Own	Pressure
Pierce-Arrow 66-A-4	6	5 x7	824.7	2.88–1	Own	T	Helical	Cent	Pressure	Gear	Westinghouse	6	Dual-D	Bosch	Hand	Own	Pressure
Pilot 6-45	6	3½x5	230.1	4.75–1	Teetor	L	Helical	Cent	Splash-Pres	Gear	Delco	6	Single	Delco	Hand	Zenith	Vacuum
Premier 6-B	6	3½x5½	295.3	4.45–1	Own	I	Helical	Cent	Splash-Pres	Gear	Delco	6	Single	Delco	Atmtc	Johnson	Vacuum
Princess 4-36-F	4	3½x4½	187.7	4.25–1	G.B.&S	L	Chain	Ther	Circ-Spl	Piston	Disco	6	Single	Splitdorf	Hand	Schebler	Vacuum
Pullman 424-32	4	3½x4½	187.7	4.50–1	G.B.&S	L	Chain	Ther	Splash-Pres	Piston	Splitdorf	6	Single	Dixie	Hand	Stromberg	Vacuum
Regal J	4	3½x4½	182.8	4.25–1	Own	L	Helical	Ther	Circ-Spl	Piston	Heinze	6	Single	Heinze	Hand	Carter	Vacuum
Regal F	8	3 x4½	254.4	4.00–1	Own	L	Helical	Ther	Pressure	Gear	Dyneto	12	Single		Hand	Johnson	Vacuum
Reo R	4	4½x4½	240.5	4.30–1	Own	L	Helical	Cent	Circ-Spl	Piston	Remy	6	Single	Remy	Hand	Johnson	Pres-Grav
Reo M	6	3 1/16x5½	306.6	4.30–1	Own	L	Helical	Cent	Circ-Spl	Piston	Remy	6	Single	Remy	Hand	Rayfield	Vacuum
Richmond 6-17	6	3½x5	288.6	4.25–1	Own	L	Helical	Cent	Splash-Pres	Piston	Delco	6	Single	Delco	Hand	Stromberg	Vacuum
Roamer	6	3½x5	230.1	4.42–1	Rutenber	L	Helical	Cent	Splash-Pres	Gear	Bijur	6	Dual	Bosch	Hand	Stromberg	Vacuum
Ross C	8	3½x5	331.8	4.64–1	Hersh-Sp	L	Helical	Cent	Pressure	Gear	Ward-L	6	Single	At Kent	H&A	Zenith	Vacuum
Saxon B-5-R	4	2½x4	94.0	5.00–1	Continent	L	Helical	Ther	Circ-Spl	Piston	Wagner	6	Single	At Kent	Atmtc	Reichbch	Gravity
Saxon S-4	6	2½x4½	175.3	4.75–1	Continent	L	Helical	Ther	Circ-Spl	Piston	Wagner	6	Single	Remy	Hand	Rayfield	Gravity
Scripps-Booth D	8	2½x3½	162.3	4.80–1	Ferro	I	Helical	Ther	Pressure	Gear	Wagner	6	Single	Remy	Atmtc	Zenith	Vacuum
Simplex	6	4½x6½	563.7		Own	L	Chain	Cent	Pressure	Gear	Bosch	6	Dual	{Bosch / Eisemann}	Hand	Newcomb	Pressure
Singer 17	6	4 x5½	414.7	3.77–1	Hersh-Sp	T	Helical	Cent	Pressure	Gear	Westinghouse	6	Single	Bosch	Hand	Rayfield	Vacuum
Standard E	8	3 x5	282.7	4.45–1	Hersh-Sp	L	Helical	Cent	Pressure	Gear	Westinghouse	6	Single	Westinghouse	Hand	Zenith	Vacuum
Standard F	8	3½x5	331.8	4.45–1	Hersh-Sp	L	Helical	Cent	Pressure	Gear	Apple	6	Single	Dixie	Hand	Zenith	Vacuum
Stearns-Knight SKL4-32	4	3½x5½	248.5	4.50–1	Own	I	Chain	Cent	Splash-Pres	Gear	Westinghouse	12	Single	Remy	Hand	Schebler	Gravity
Stearns-Knight SK8-33	8	3½x5	331.8	4.75–1	Own	I	Chain	Ther	Splash-Pres	Gear	Westinghouse	12	Single	Remy	Hand	Rayfield	Vacuum
Stephens 60-65	6	3½x4½	224.0	4.75–1	Continent	L	Helical	Cent	Circ-Spl	Piston	Auto-Lite	6	Single	Conn	Hand	Zenith	Vacuum
Studebaker SF4-40	4	3½x5	235.8	4.00–1	Own	L	Helical	Cent	Circ-Spl	Gear	Wagner	6	Single	Remy	Hand	Schebler	Vacuum
Studebaker ED6-50	6	3½x5	353.8	3.70–1	Own	L	Helical	Cent	Circ-Spl	Gear	Wagner	6	Single	Remy	Hand	Schebler	Vacuum
Stutz R	4	4½x5½	389.9	3.06–1	Wisconsin	I	Helical	Cent	Pressure	Gear	Remy	8	Single	Bosch	Hand	Stromberg	Pressure
Sun 17	6	3½x5	230.1	4.75–1	Own	L	Helical	Cent	Splash-Pres	Piston	Remy	7	Single	Remy	Hand	Rayfield	Vacuum
Templar 445	4	3½x5½	196.8	4.45–1	Own	I	Chain	Cent	Pressure	Gear	Remy	6	Single	Remy	Hand	Zenith	Vacuum
Templar 645	6	3 x5	212.0	4.45–1	Own	I	Chain	Cent	Pressure	Gear	Remy	6	Single	Remy	Hand	Zenith	Vacuum
Velie Biltwell 28	6	3½x4½	224.0	4.33–1	Continent	L	Helical	Cent	Splash-Pres	Piston	Remy	6	Single	Remy	Atmtc	Stromberg	Vacuum
Velie Biltwell 27	6	3½x5½	303.1	4.08–1	Continent	L	Helical	Cent	Splash-Pres	Piston	Remy	6	Single	Remy	Atmtc	Stromberg	Vacuum
Westcott S-17	6	3½x5½	303.1	4.45–1	Continent	L	Helical	Cent	Splash-Pres	Piston	Delco	6	Single	Delco	H&A	Rayfield	Vacuum
White 16 Valve Four	4	4½x5½	326.3		Own		Helical	Cent	Pressure	Gear	Lecce-N	12	Single	{Eisemann / Bosch}	Hand	Own	Vacuum
Willys-Knight 88-4	4	4½x4½	240.5	4.30–1	Own	I	Chain	Ther	Splash-Pres	Piston	Auto-Lite	6	Single	Conn	Hand	Tillotson	Vacuum
Willys-Knight 88-3	8	3½x4		4.6 –1	Own	I	Chain	Ther	Pressure		Auto-Lite	6	Single		H&A	Zenith	Vacuum
Willys 88-6	6	3½x5½	303.1	4.00–1	Continent	L	Helical	Cent	Splash-Pres	Piston	Auto-Lite	6	Single	Conn	Hand	Tillotson	Vacuum
Winton 33	6	3½x5½	347.9	4.45–1	Own	L	Chain	Cent	Pressure	Piston	Bijur	6	Single	Bosch	Hand	Rayfield	Vacuum
Winton 48	6	4½x5½	524.8	4.08–1	Own	L	Chain	Cent	Pressure	Piston	Bijur	6	Single	Bosch	Hand	Rayfield	Vacuum
Woods Dual Power 1600	4	2½x3½	68.7	8.25–1	Special	L	Helical	Ther	Circ-Spl	Gear			Single	At Kent	Atmtc	Zephyr	Gravity
Yale	8	3½x4½	276.1	4.45–1	Mass-Ph		Chain	Ther	Circ-Spl		Disco	6	Single	Remy	Hand	Rayfield	Vacuum

ABBREVIATIONS:—**Make of Engine:** Continental, Continent; Herschell-Spillman, Hersh-Sp; Golden, Belknap & Swartz, G.B.&S.; Massnick-Phipps, Mass-Ph. **Cylinder Shape:** L-Head, L; I-Head, I; T-Head, T. **Camshaft Drive:** Spur Gears, Spur. **Water Circulation:** Centrifugal, Cent; Thermo-syphon, Ther. **Lubrication System:** Splash-Pressure, Splash-Pres; Circulating-Splash, Circ-Spl. **Oil Pump Type:** Impeller, Imp. **Electric System:** Ward Leonard, Ward-L; Gray & Davis, G & D; Allis-Chalmers, Allis-Ch; Leece-Neville, Leece-N. **Ignition System:** Dual-Double, Dual-D. **Ignition Make:** Atwater Kent, At Kent. **Ignition Control:** Hand and Automatic, H&A; Automatic, Atmte. **Make of Carbureter:** Reichenbach, Reichbch; Longuemare, Longmare. **Clutch Type:** Multiple Disk, Mul-D. **Gearset Type:** Selective, Sel; Planetary, Plan; Friction, Fric. **Gearset Location:** Unit with Motor, Unit M; Unit with Axle, Unit X; Amidship, Amid; Unit with Torque Tube, Unit T. **Final Drive:** Spiral

Their Technical Specifications—Continued

| TRANSMISSION | | | | | | | | | RUNNING GEAR | | | | | | | | |

The FORUM

A Criticism of the Constant Pressure Cycle

By E. H. Sherbondy

AN essay on the possibilities of the constant pressure cycle for use in automobile engines has been presented in the proceedings of the S. A. E. by Messrs. Chase and Browne, in which a diagrammatic engine was shown for carrying out the cycle.

The paper as a whole was discussed and commented on by James Langmuir Napier in the August issue of *The Automobile Engineer*, in which he has shown that under certain conditions, the theoretical thermal efficiencies of both cycles may be the same, and he further pointed out the important fact that the sizes of cylinders required for a given power output are for the constant volume and constant pressure cycles, respectively, 3 and 14.32. However, in making his criticisms he neglected the possible improvements in the cycle when regenerators are used.

Questions Regeneration

The possibilities of carrying out regeneration in the manner suggested by Messrs. Chase and Browne, appear very limited when an analysis is made. The size and weight possessing even a fair efficiency would be in excess of what is in average practice for water cooling radiators. If, in a constant volume engine, compression is carried out in auxiliary cylinders and the compressed air is then led to a receiver as is proposed by Messrs. Chase and Browne, the receiver volume would have to be of prohibitory proportions to carry out the proposed cycle.

Practically, of course, it is impossible to build such a thing as a constant pressure internal combustion engine, since chemical actions accompany the mechanical actions of the gases, in actual working engines. Indicator cards from all Diesel engines testify to the truth of this assertion. The conditions for the best thermal efficiency in a heat engine are that each heat element should be supplied to the working fluid at the highest possible temperature and pressure and rejected at the lowest possible temperature and pressure. Structural considerations absolutely limit both these conditions.

Large Heat Loss

As has been frequently pointed out, prolonged combustion causes enormous heat loss to the cylinder walls, and if other unfavorable factors did not intervene in the proposed cycle, the combustion temperatures accompanying the production of mean effective pressure of 100 lb. per sq. in. in low pressure, constant pressure engines would suffice to quickly render an actual engine inoperative through overheating of cylinder walls and piston.

The subject of heat work conversion cycles was investigated thoroughly and discussed at great length following on the appearances of Dr. Diesel's book: "A Rational Theory of a Heat Motor" 20 years ago, by Junkers, Meyer, Stodola, Schlötter, and other competent technical authorities. (See Zeitschrift Des Veneines Deutsches Inginieur and Proceedings of Institution of Mechanical Engineers, England.) The conclusions arrived at point out that the nature of the cycle will be influenced very largely by the physical character of the fuel to be used. The constant pressure cycle will remain without possibilities for automobile propulsion.*

*As there was an unavoidable delay in publishing this letter, a proof of it was submitted to Mr. Chase, whose reply follows.

Answering the Criticism

By Herbert Chase

MR. SHERBONDY has overlooked the fact that in our reply to Mr. Napier in THE AUTOMOBILE for Nov. 30, we proved beyond question that the possible power output and the thermal efficiency of the proposed constant pressure engine can readily be made greater for a given bore and stroke than the output of any recognized type of constant volume engine of equal bore and stroke. Until the figures we gave are proven incorrect our conclusions must stand.

Mr. Sherbondy is entirely mistaken in his statement that we proposed any type of constant volume engine in which "compression is carried out in auxiliary cylinders." We made no such statement. In fact, one of the particular features of the proposed engine (which, by the way, is of the *constant pressure* and not a *constant volume* type) is the fact that compression is carried out in the working cylinder and *not* in an auxiliary cylinder such as Brayton used.

Criticisms Require Proof

Mr. Sherbondy's statement that it is "impossible to build such a thing as a constant pressure internal combustion engine" is absurd in view of the fact that Brayton and others accomplished this very thing—and that before Dr. Otto invented his constant volume engine. The Diesel engine as described in Dr. Diesel's early patents was of the constant *temperature*, *not* of the constant *pressure* type, although in practice it comes nearer to the latter than to the former type. It is, in fact, usually regarded as a constant pressure engine, and since with the high compression pressure used (and correspondingly high temperatures) it has proved feasible to cool engines of the Diesel type, and still obtain high efficiency, is it not entirely reasonable to conclude that an engine of the true constant pressure type, using much lower pressures than those of the Diesel engine, can be quite as readily cooled? The answer is self-evident—it was in fact demonstrated beyond question even in the Brayton engines, not to mention numerous semi-Diesel engines.

Until Mr. Sherbondy's statements regarding the possibilities of carrying out regeneration "and the prohibitive proportions" of the receiver are supported by some definite proof they must be regarded as quite as questionable as his other statements refuted above. We entirely disagree with his views in this regard, but to disapprove them completely would require submission of a finished design which we are not prepared to submit at this time.

Our critic is, of course, entitled to his opinion that "the constant pressure cycle will remain without possibilities for automobile propulsion," but if this conclusion rests, as it would appear to do, upon the same unsound basis as his other conclusions it can hardly be regarded as worthy of general acceptance.

Eliminates Piston Pin

British Inventor Suggests Use of Enlarged Connecting-Rod Upper End to Replace Piston

AS a rule, neither the small end bearing of the connecting-rod nor the wrist pin or piston bosses are nowadays apt to give trouble or wear unduly. There are, however, certain disadvantages in the usual piston and connecting-rod assembly which the inventor of the pistons shown in the accompanying sketches claims to have overcome, at least to a certain degree.

The fundamental idea, embodied in each of the alternative designs shown, is to employ the head of the connecting-rod itself as the actual receiver of the pressure of the expanding charge. To this end the connecting-rod terminates in a hollow spherical or part spherical head, of such size as almost to fill the cylinder in which it is to operate. Just sufficient clearance is allowed to permit of a cylindrical sleeve being interposed. The sleeve, it will be seen, is fitted with compression rings to prevent loss of gas over its outer face, but the closeness of fit and the film of oil are relied on to retain compression between the head and the sleeve.

Various Adaptations

In the design A, shown in section, the hollow head is separate from the connecting-rod, an extension of the latter passing through a central hole in the former, the two being held together by a nut. B is similar in design, except for the location of the piston rings, and the greater wearing surface this difference allows.

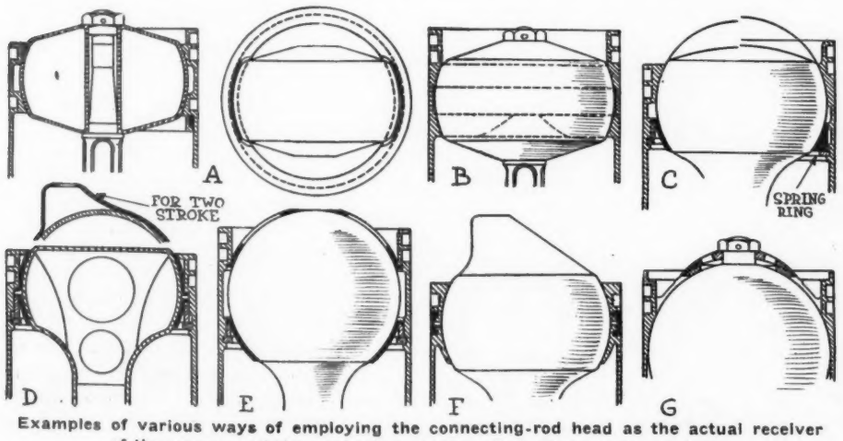
Between A and B is a figure explaining how the sleeve is removed from or replaced on the head. The nut holding the head to the connecting-rod has been removed and the sleeve and head withdrawn bodily. By then tilting the sleeve about the head till it is horizontal instead of vertical, two cutaway portions in the lower part of the spherically shaped retainer allow the sleeve to be drawn off endways; that is, in the direction of the observer's eye, as looked at in the figure.

With Head Integral

In the other designs indicated the hollow head forms an integral part of the connecting-rod, so that some other method has to be adopted to permit the assembly, or separation of the head and sleeve. In *C*, *D* and *E* the lower retainer or seating is separate from the piston, and is inserted after the spherical head is in place. A split ring in a groove on the outer face of the retainer springs outward into an annular recess in the sleeve, and so locks the whole. The retainer may be in two parts when the big end of the connecting-rod is too large for a single ring to be slipped over it, but the spring ring is, of course, in one piece.

In the design *D* a strengthening web in the interior of the head is shown, while an alternative form of top suitable for two strokes is also indicated.

A very large bearing surface is provided in design *E*. The upper retainer is almost hemispherical, and comprises a thin sheet pressing, much perforated to enable the explosion pressure to act directly on the head. The lower retainer is also a part spherical pressing, held in place by a split ring.



Examples of various ways of employing the connecting-rod head as the actual receiver of the pressure of the expanding charge. T. J. Biggs is the designer

In *F* the sleeve is in two parts, held together by a channel section ring, as shown; the ring in question also, if desired, acting as a piston ring.

In *G* the sleeve becomes almost a normal piston, except for the method of attachment to the connecting-rod, which is by a washer and nut. The under surface of the washer is ground to the same radius as the upper surface of the piston, and both washer and piston top are perforated. As the connecting-rod oscillates, the washer, of course, rides over the face of the piston.

Among the advantages claimed, some of which are obviously justified, are 1—Elimination of the gudgeon pin. 2—Increased size of small end bearings. 3—Universal action of the joint, eliminating the ill effects of slight errors in machining the ordinary design. 4—The extent of oil film tends to prevent "knocking." 5—Oil in the crankcase is kept away from the main source of heat—the top and under side of ordinary type pistons—thereby preventing oil wastage and carbonization. 6—Considerable saving in weight.

In connection with the last claim, the designer, T. J. Biggs, states he can build the two elements of steel to be of less weight than are the aluminum piston and steel connecting-rod of the usual design. And there is no reason, he says further, why the sleeve and spherical head should not be of aluminum, and, therefore, lighter still.—*The Light Car*, Coventry, England.

Safety First in England

THE safety-first campaign inaugurated some time ago by the London General Omnibus Co. is familiar to all users of buses and tubes in London. Owing to the increase of accidents, however, the time is considered ripe for the extension of the campaign throughout the country and London in particular, and with a view to this being carried into effect a meeting organized by H. E. Blain, operating manager of the L. G. O. and Underground Railways, was held at Caxton Hall, Westminster.

The whole subject was thoroughly discussed, and secretaries *pro tem.* were appointed with a view to the establishment of a London safety-first campaign council. Public education was suggested.—From *The Autocar*.

Automobiling Gains in Porto Rico

U. S. A. Cars Used Entirely—City Streets Narrow, But Country Roads Are Excellent, Though Hard on Tires

By John B. Maus
Export Manager, Fisk Rubber Co.

Several U.S.A.-built cars crossing one of the streams encountered in the mountains on the trip from San Juan to Ponce at the other end of the island, a distance of about 100 miles. The natives lend a hand when bull teams are not available to assist the cars to the other side of the water

JOHN B. MAUS

Export manager of the Fisk Rubber Co., Chicopee Falls, Mass., who has recently returned from a trip through Porto Rico during which he made a close study of conditions. Mr. Maus has been connected with the automobile industry for about 14 years

ALTHOUGH San Juan streets are so narrow that on many of them travel can be permitted in only one direction, automobiling is rapidly gaining in popularity, not only in the city, but throughout the Island of Porto Rico. This island, which is almost as little known to the American public as some of those in the South Seas, is exceedingly picturesque and contains numerous beauty points, lending unusual interest to touring. The traces of Moorish and Spanish architecture found throughout the city of San Juan and in other towns impart a distinctly romantic touch to their surroundings, and the wonderful scenery in the country may best be judged by the illustrations appearing herewith.

American automobiles are used entirely in Porto Rico, some leaders represented being Ford, Overland, Buick, Hudson, White and Packard. Car and accessory dealers are prospering as may be expected with an unusually large sugar crop for the coming season. Last year 225 cars were sold on the island, of which forty-eight were medium priced six-cylinder machines, indicating that power is a necessity for this market.

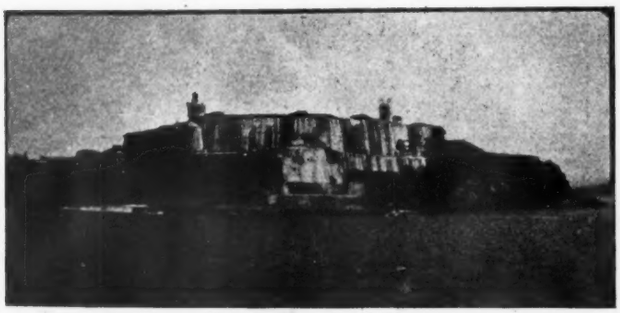
Because cars have to be driven at very high speed to ascend many of the severe grades encountered on the 350 miles of hard flintlike roads which traverse the island and because of the rear wheels being swung around constantly on the numerous curves, the effect on the rubber tread of tires is like that produced by rubbing a rasp over them. Moreover, the climate seldom changes, being very warm and particularly hot in direct sunlight, so that a tire must contain real rubber from a hot climate because a highly-compounded tire will soon crumble and go to pieces. Non-skid tires are desirable, principally because they give better traction, but also because they lift part of the tread from the hot road surface, thereby giving less friction and presenting a thicker tread which insures longer service. U. S. A.-made tires are much in evidence, among the most prominent being Fisk Red Top tires, United States brands and Goodyear and Goodrich products. These are distributed much on the order of distribution in the United States with similar prices prevailing.

An important factor in the increase of automobiling is the disappearance of fear of self-propelled vehicles resulting from widening education. The favorite method of transportation from Porto Rico has always been by bull teams drawing

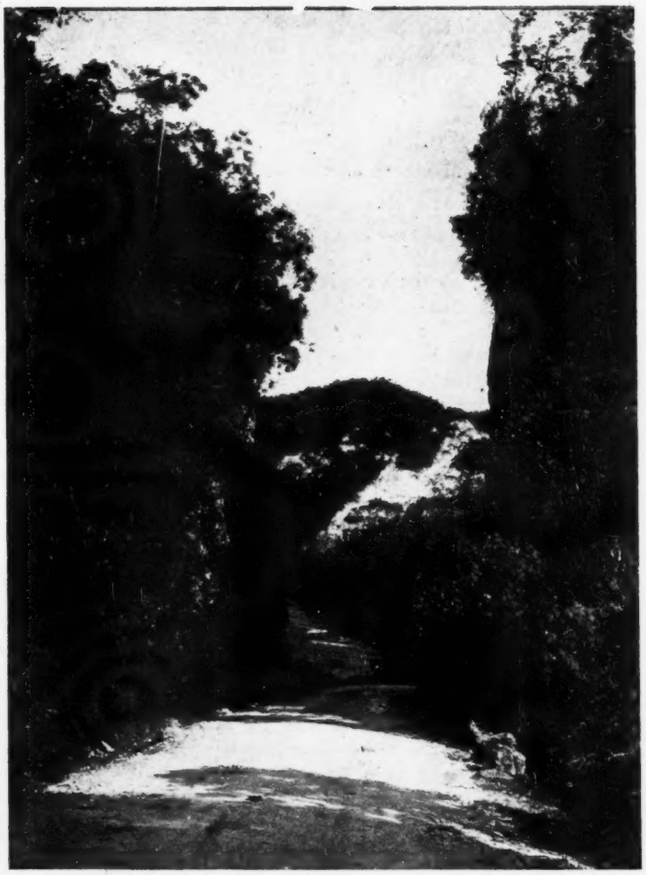
Porto Rico—Island of Enchantment

At the left is a view of the Camerio road which winds through the mountains of the interior of Porto Rico and connects with the ancient military road built during the Spanish regime hundreds of years ago by Chinese coolies and pirates. It is still in excellent condition

Crossing Barceloneta River with the aid of a bull team



Morro castle is one of the picturesque features of Porto Rico, commanding the approach to San Juan harbor and embodying many romantic traditions. Its thick concrete walls are partly covered with green vines which soften the stern aspect of the ancient pile. There is a secret underground passage to San Cristobal, another old fortification near by



A mountain pass at Arecibo. At this spot the roadway is cut through solid stone, an operation inolving a prodigious amount of effort as it was performed long before dynamite became a factor in road construction. A tremendous amount of labor and patience was expended in carrying out this work by hand and this is but one of many similar examples

Some of the cocoanut palms in a public park in San Juan

Favorite method of transportation by bull team in the interior of the island. Automobiles and motor trucks will some day displace these primitive vehicles

large wagons of the prairie type which have huge wooden wheels.

The city of San Juan is on a small island connected to the mainland of Porto Rico by a small concrete bridge. The Calle Central leads from San Juan to the island proper where a splendid piece of fairly wide road connects at Santurce, a suburb, with the road around the north end of the island by the way of Bayamon to Arecibo, Aguadilla, etc., to the extreme end of the island, where is situated the second city in size and a port known as Ponce. Returning on the southern side of the island, the road leads over a series of mountains, many of which range as high as 3500 ft., and connects with the famous military highway built several hundred years ago under the Spanish régime by Chinese coolies and pirates. This road is a marvel in construction and from the highest point looks like a narrow white ribbon, spirally linking one mountain with another. Ofter one may tour for an hour over these roads to suddenly return within a hundred yards of the very spot passed within that time. It would be difficult to find many points along these roads where a straight line of more than 100 ft. can be seen, rendering driving difficult. The roads do not follow the contour of the valley, but must have been begun by suspending workmen by ropes from the tops of the mountains to cut away the stone for a foothold, and from the point of vantage thus gained continuing the construction until the roads on adjacent mountains were carried to a point where a narrow cement bridge could be thrown across to connect them.

Educational work being carried on by the United States government is doing much to elevate the intelligence of the 1,200,000 people on the island, of whom some 325,000 are children under the age of ten and going to school, where many of them are taught by American teachers provided by the government.

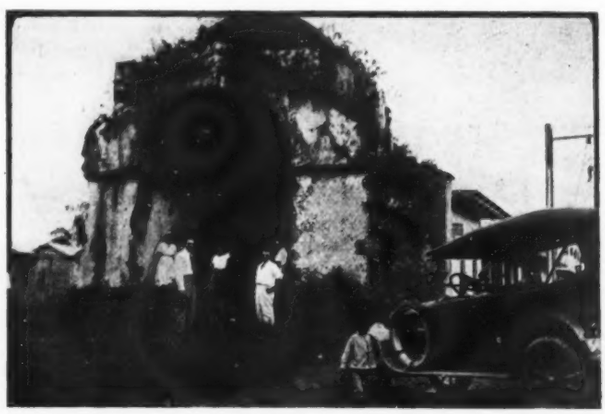
There are but two railroads on the island, both narrow-gage; one is the American Central, which runs from San Juan to Ponce, taking a day for the 100-mile trip; the other runs from San Juan to Bayamon, a distance of about 25 miles, and is used principally during the sugar season. Besides sugar, which is the leading product of the island, Porto Rico grows cocoanuts, bananas, coffee, guava and lemons in abundance. The natives are progressive and in 20 years Porto Rico will be one of the most up-to-date and prosperous islands in the South.

At present in the business streets of San Juan there is occasionally a store with a modern front and display window, although 90 per cent of the business houses are still of the old cement construction, seldom more than two stories high and with no facilities for displaying goods, except by congesting the big entrance with all sorts of salable articles. The business men are cramped in small quarters and, because of the climate, do little between 10 a. m. and 3 p. m., after which time comes a refreshing breeze that tempers the heat. As there is no humidity the heat does not affect one greatly, provided he remains in the shade during the hottest part of the day.

One of the points of special interest on the island is the cathedral in San Juan, which once contained the bones of Christopher Columbus, and the altar in which they rested still exists, identified by a beautiful Italian carving of an angel weeping over Columbus, whose remains were later taken to Spain. In another part of the church, among some twelve or fourteen altars, is that of Saint Pius. Removing the heavy red and gold drapery over the main table of the altar, a wax figure which is an exact reproduction of Saint Pius in life is revealed. This was created by reproducing his body in wax over his skeleton and adding the necessary coloring and the clothing which he wore in life. Pius was canonized as a saint after it was discovered that he was innocent of the murder for which he was executed.

Another interesting sight in San Juan is the old gate, a relic of the wall which surrounded the city during the Spanish régime. This gate still contains the heavy oak door with iron fastenings that are typical of ancient Spanish construction.

At the extreme end of the city is the picturesque Morro Castle built of thick cement and in many places covered with green vines. It contains dug-outs that were once filled with the bones of Chinese pirates. The castle is now used as a barracks for United States soldiers. There is a secret underground passage from Morro Castle to San Cristobal, another antique fortification to the right of Morro which was also part of the wall around the city.



Oldest church in Porto Rico, established several hundred years ago

Industrial Miscellany

Factory

Plymouth Motor Castings Co., Plymouth, Mich., will shortly complete the first two units of the four-unit plant. These will be 50 by 100 ft. Two other units, each 50 by 208 ft., will soon be erected. The company plans to provide homes for its workmen and will build the first twenty houses in the near future.

King Works, Adrian, Mich., maker of automobile parts, has bought a plant and will add considerable equipment.

Lang Motor Truck Co., Pittsburgh, Pa., will erect a two-story building on Hamilton Avenue, to cost about $40,000.

Reliable Auto Heater Co., Cleveland, has leased the plant formerly occupied by the Ashtabula Mfg. Co., Ashtabula, Ohio.

Acme Tire & Rubber Co., Toronto, Ont., will erect a plant in Oakville, Ont.

Locomobile Co. of America, Bridgeport, Conn., is expected to soon award a contract for an addition, 100 by 160 ft., one story, and of a roof, 30 by 600 ft., over a space between two of the present buildings.

Vaughn Mfg. Co., Jefferson, Wis., maker of harrows, drills, seeders, etc., will produce on a small scale light motor trucks using the Ford chassis as a nucleus.

Standard Wheel Co., Terre Haute, Ind., is constructing a foundry, which will be used for the manufacture of malleable iron castings for wheels and automobile hubs. It will be completed about Feb. 1.

Pierce-Arrow Motor Car Corp., Buffalo, N. Y., is planning the construction of a one-story addition to cost $10,000.

Dan Kidney & Sons, DePere, Wis., one of the largest builders of motor boats in the Northwest, has installed equipment for the production of automobile and truck bodies to keep the plant fully engaged during the usual winter slack season. The company is specializing in closed bodies for passenger cars and has orders enough to keep occupied until midsummer.

M. & S. Corp., Detroit, has installed its new plant for the manufacture of differentials and will increase its equipment by Feb. 1 to give a capacity of 400 differentials per day. The company shipped more than 100 differentials per day in November.

Marvel Accessories Mfg. Co., Cleveland, will soon complete the $60,000 plant. The company now occupies space of 1200 sq. ft. The new quarters will give it 25,000 sq. ft.

Flying Dutchman Aerial Co. is negotiating with the Muskegon, Mich., Chamber of Commerce for the establishment of an aeroplane factory there. This concern was recently organized with a capital of $30,000 by J. Buchanan and S. L. Buchanan of Holland, Mich., and W. L. Baudette of Grand Rapids.

Aluminum Goods Mfg. Co., general offices, Manitowoc, Wis., is considering plans for the establishment of a complete aluminum rolling mill unit in connection with its main works and foundry at Manitowoc. The company operates at Two Rivers, Wis., and Newark, N. J.

Timken-Detroit Axle Co., Morgan & Wright Tire Co., Detroit Seamless Steel Tube Co., McCord Mfg. Co. and the Jeffery-Dewitt Co. have pledged themselves to influence workers to enter the city night schools beginning January, promising that jobs will depend on the knowledge of the English language.

Canadian Aeroplanes, Ltd., with a capital stock of $50,000 has been launched at Toronto, Ont.

General Tire & Rubber Co., Akron, will enlarge its factory by a $50,000 addition.

The Automobile Calendar

ASSOCIATIONS

Jan. 6-13—New York, Mid-Winter Meeting of Society of Automobile Engineers, Engineering Society Bldg.
Jan. 9—New York City, National Automobile Chamber of Commerce, Annual Banquet at Waldorf-Astoria.
Jan. 9-11—New York City, Society of Automobile Engineers' Mid-Winter meeting, Thursday, Jan. 11, S. A. E. day. Annual Banquet, Hotel Biltmore. Special performance Ziegfeld's Midnight Follies.
Jan. 10—New York City, Motor and Accessory Manufacturers' Banquet, Waldorf-Astoria.
Jan. 24-26 — Chicago, Second Annual Meeting National Assn. of Automobile Accessory Jobbers. Congress Hotel.

CONTESTS

1917

April—Los Angeles to Salt Lake City Road Race.
May 19—New York Metropolitan Race on Sheepshead Bay Speedway.
May 30—Indianapolis Speedway Race, Championship.
June 9—Chicago, Ill., Speedway Race, Championship.
June 23 — Cincinnati, Ohio, Speedway Race.
July 4—Omaha, Neb., Speedway Race, Championship.
July 4—Tacoma, Wash., Speedway Race, Championship.
July 14 — Des Moines, Iowa, Speedway Race, Championship.
Aug. 4—Kansas City Speedway Race.
Sept. 3—Cincinnati, Ohio, Speedway Race. Championship.
Sept. 15 — Providence, R. I., Speedway Race, Championship.
Sept. 29—New York, Speedway Race. Championship.
Oct. 6—Kansas City Speedway Race.
Oct. 13 — Chicago, Speedway Race.
Oct. 27—New York Speedway Race.

SHOWS

Dec. 30-Jan. 6—Cleveland Automobile Accessory Show, Dreamland Auditorium.
Dec. 30-Jan. 6—Cleveland, Ohio, Sixteenth Annual Show, Wigmore Coliseum, Cleveland Automobile Club.
Jan. 2-10—New York, Automobile Salon, Hotel Astor, J. R. Eustis, Mgr.
Jan. 6-11—Milwaukee Auditorium, Milwaukee Automobile Dealers.
Jan. 6-13 — New York City, Show, Grand Central Palace, National Automobile Chamber of Commerce.
Jan. 9-10 — Fort Dodge, Ia., State Convention, Iowa Retail Automobile Dealers' Assn.
Jan. 12-20—Philadelphia, Show, Philadelphia Automobile Trade Assn.
Jan. 15-20—Fall River, Mass., Show, Casino.
Jan. 20-27—Detroit, Mich., 16th Annual Show, Detroit Automobile Dealers' Assn.
Jan. 22-27—Rochester, N. Y., Show, Exposition Park, Rochester Auto Trades Assn.
Jan. 22-27—Manchester, N. H., Academy.
Jan. 22-27—Buffalo, N. Y., Show, Broadway Auditorium, Buffalo Automobile Dealers' Assn.
Jan. 23-27 — Oklahoma City, Okla., Show, Auditorium.
Jan. 23-27 — Baltimore, Md., Show, Fifth Regiment Armory.
Jan. 25-27—Asheville, N. C., Show, Asheville Automobile Trade Assn.
Jan. 27-Feb. 3—Columbus, O., Show, Memorial Hall, Columbus Dealers' Assn.
Jan. 27-Feb. 3, 1917—Chicago, Ill., Show, Coliseum, National Automobile Chamber of Commerce.
Jan. 27-Feb. 5 — York, Pa., Show, York Automobile Dealers' Assn.
Jan. 20-27—Montreal, Que., Automobile Trade Assn.
Jan. 28-Feb. 3 — Wilmington, Del., Show, Hotel duPont.
Feb. 3-10—Minneapolis, Minn., Show, Minneapolis Automobile Trade Assn.
Feb. 5-9—Boston, 8th National Good Roads Show, Mechanics' Bldg.
Feb. 5-10—Bangor, Me., Bangor Automobile Assn., Auditorium.
Feb. 8-15—First Pan-American Aeronautic Exposition, New York City; Aero Club of America, American Society of Aeronautic Engineers, Pan-American Aeronautic Federations.
Feb. 10-17 — Hartford, Conn., Show, State Armory, First Infantry.
Feb. 10-18—San Francisco, Cal., Pacific Automobile Show, G. A. Wahlgreen, Mgr.
Feb. 12-17—Bay City, Mich., Show, Armory.
Feb. 12-17 — Louisville, Ky., Show, First Regiment Armory. Louisville Automobile Dealers' Assn.
Feb. 12-19 — Indianapolis, Ind., Show, Steinhart Bldg., Indianapolis Automobile Trade Assn.
Feb. 14-17—Peoria, Ill., Coliseum, Automobile and Accessory Dealers' Assn.
Feb. 17-24 — Newark, N. J., Show, First Regiment Armory.
Feb. 18-25 — St. Louis, Mo., Show, Automobile Manufacturers' and Dealers' Assn.
Feb. 19-24—Springfield, Ohio, Show, Memorial Hall, Springfield Automobile Trade Assn.
Feb. 19 — Pittsfield, Mass., Show, Armory. J. J. Callahan, Mgr.
Feb. 19-24 — South Bethlehem, Pa., Show, Coliseum.
Feb. 19-24 — Grand Rapids, Mich., Show, Automobile Business Assn. of Grand Rapids.
Feb. 19-24 — Duluth, Minn., Show, Duluth Auto Dealers' Assn., Armory.
Feb. 19-24—Bridgeport, Conn., Show, Armory, Coast Artillery Corps.
Feb. 19-24—St. Louis, Overland Bldg., St. Louis Auto Dealers' Assn.
Feb. 19-24—Syracuse, N. Y., Show, State Armory, Syracuse Dealers' Assn.
Feb. 24-March 3 — Brooklyn, Show, 23rd Regiment Armory.
Feb. 26-March 3—Omaha, Neb., Show, Auditorium, Omaha Automobile Show Assn.
Feb. 27-March 4—Atlanta, Ga., Show, Auditorium, Atlanta Auto Trades and Accessory Assn.
March 1, 2, 3—Urbana, Ill., Show, Automobile Trade Assn. of Champaign Co. Armory of the University of Ill.
March 3-10 — Boston, Mass., Show, Mechanics' Bldg., Boston Automobile Dealers' Assn.
March 6-10—Ft. Dodge, Iowa, Northern Iowa Show, New Terminal Warehouse, G. W. Tremain, Secretary.
March 14-17—Davenport, Iowa, Show, Coliseum Bldg., Tri-City Auto. Trade.
March 17-22 — New Haven, Conn., Show, Hotel Taft.
March 18-23—Cedar Rapids, Ia., Cedar Rapids Automobile Trades Assn.
April—Calumet, Mich., Show, Coliseum, Frank Ketchell, Mgr.

Cars with Eight and Twelve Cylinders

(*Continued from page* 84)

high in the frame so that the valve tappets, etc., are accessible. National is using the circulating form of pressure oiling in which there is a continuous passage through the whole length of the crankshaft. Oil fed to either of the three main bearings can thus reach any of the crankpins and the lower end of the connecting rods and any accidental clogging of one main bearing supply would not starve even that bearing, because it would then receive its oil from within the crankshaft. An interesting detail in the lubrication is the use of an adjustable reducing valve which sends a low pressure supply of oil to the front end gears. The thermostat has been added. Great care is taken to keep the intake gases warm, the center pipe which carries the carbureter and connects to the longitudinal manifolds being waterjacketed, all the water passing this way as it goes to the radiator. Furthermore, a portion of each intake manifold is exhaust jacketed. There have been some changes in the body and the radiator is high and narrow. A slanting windshield is fitted and a number of body fittings are improved.—*National Motor Vehicle Co., Indianapolis, Ind.*

Regal

The Regal eight is being continued without change of model for 1917. The four is described on page 69.—*Regal Motor Car Co., Detroit, Mich.*

Ross

The main improvements in the Ross eight are the adoption of a heavier frame, providing a firmer foundation for the body; increase of tires from 34 x 4 to 35 x 4½, the use of leather upholstery, and the adoption of yellow wheels to go with the standard body color, which is green. Formerly green wheels were used. A double-cowl has been adopted and the hood slopes into the cowl without a break, the radiator shell also being curved to meet modern requirements. Doors are wide and fit snugly, and the rake of the steering column adds to the racy appearance. The eight-cylinder Herschell-Spillman engine is continued along with other standard units which go to make up the chassis.—*Ross Automobile Co., Detroit, Mich.*

Standard

Very little alteration has been made to the Standard eight beyond an addition of ¼ in. to the bore, making it 3¼ in. Also the starting and lighting is now by a Splitdorf equipment and there is a Dixie magneto to replace the battery ignition. Throughout the chassis oil cups have replaced grease cups. The body lines and finish have been greatly improved. On the seven-passenger model the double cowl has been removed and the edges of the radiator rounded and the water chamber at the top of the radiator made to overhang slightly.—*Standard Steel Car Co., Pittsburgh, Pa.*

Scripps-Booth

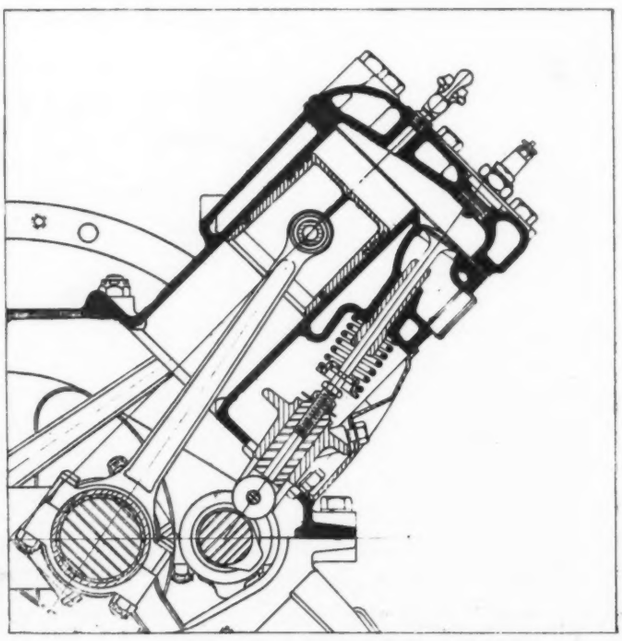
No changes will be made in the Scripps-Booth eight, this being quite a new model. It is made in four-passenger form with a close coupled body the general chassis characteristics being closely similar to those of the four described on page 69.—*Scripps-Booth Co., Detroit, Mich.*

Stearns

The Stearns eight, like the four, is to be continued without substantial change in design. It was the first eight-cylinder Knight engine to be put on the market, and has a number of ingenious features. As can be understood readily, the task of fitting all the sleeve operating connecting rods into the narrow space at the head of the V is no sinecure. There are, therefore, two shafts for the two sets of sleeves, these being geared together at the front end and the two gears are used for the oil pump. One of the shafts is carried through and driven by silent chain, the other shaft being driven by means of the gears that are pumping oil. Various other Stearns features are described on page 70.—*F. B. Stearns Co., Cleveland, Ohio.*

Willys-Knight

The eight-cylinder Knight model is the feature of the Willys-Overland list. The new Knight is in reality nothing radical. Ordinary Knight practice is incorporated in the V-block which has proven so successful in the last three years in poppet design. The eight cylinders are cast in two blocks of four and have bore and stroke dimensions of 3⅜ by 4 in. In arranging for the valve drive the eccentric shaft is placed on the centerline of the engine between the V-blocks so that one shaft takes the drive for all the eccentrics. This shaft is directly above the crankshaft and gives a very compact layout. Outside of the fact that this shaft drives sixteen of the Knight sleeves instead of eight or twelve there is nothing unusual about it. The eccentric rods are joined in the customary manner to lugs on the bottom of the sleeves. Cooling is by thermo syphon, ignition by a single battery system and gasoline feed by the vacuum method. The entire chassis layout is similar to that of the Knight four described in THE AUTOMOBILE Aug. 10, 1916. The wheelbase, however, is longer, as in this instance it is 125 in., whereas on the four it is 121 in. The clutch is a cone, leather faced, and fitted with a clutch brake to assist in gear shifting. The gearset, in line with previous Overland practice is in a unit with the rear axle. This is a double heat-treated nickel steel set, with stub teeth mounted on roller and ball bearings. The rear axle is floating with spiral bevel drive. The differential is a four-pinion type and the rear wheels are carried on adjustable taper roller bearings. The body fitted to this car is a seven-passenger touring type with a one-piece cowl and a cowl on the back of the front seat.—*Willys-Overland Co., Toledo, Ohio.*



Inclined valves used on Oldsmobile eight